Exponent®

EXTERNAL MEMORANDUM

TO:	Veolia Water Milwaukee, LLC
FROM:	Exponent, Inc.
DATE:	October 19, 2026
SUBJECT:	Jones Island and South Shore Water Reclamation Facilities—Targeted Compliance Evaluation

1 Executive Summary

Exponent was retained by Troutman Pepper Locke on behalf of Veolia Water Milwaukee, LLC (Veolia), to independently evaluate whether Veolia performed activities consistent with its obligations under the Agreement between Veolia and the Milwaukee Metropolitan Sewerage District (MMSD or the District) (the Agreement or the Veolia Agreement). Exponent reviewed data and records from January 2016-August 2026 (or, in some specific cases, shorter periods based on available documentation) focusing on two components of the Agreement: (i) an Environmental Compliance Evaluation and (ii) a review of Maintenance and Operational Readiness.

Exponent's Environmental Compliance Evaluation concluded that Veolia maintained consistent and substantive compliance with monitoring requirements, Wisconsin Pollutant Discharge Elimination System (WPDES) permit effluent limits, WPDES combined sewer overflow (CSO) performance standards, and the Veolia Agreement's effluent performance standards. Specifically, Exponent found that:

- Veolia collected effluent samples as required by the WPDES permit more than 99.9% of the time.
- The South Shore Water Reclamation Facility (SSWRF, Outfall 001) and the Jones Island Water Reclamation Facility (JIWRF, Outfall 002) were in compliance with WPDES permit effluent limitations for 99.97% and 99.94% of sample results in the evaluation period, respectively.

- The SSWRF and JIWRF were in compliance with Veolia Agreement effluent performance standards at Outfalls 001 and 002 for 95.82% and 99.68% of sample results in the evaluation period, respectively.
- The MMSD system had six or fewer combined sewer overflow (CSO) events per year from January 2016 through June 2026 and thus met WPDES permit CSO performance standards. Further, Veolia's compliance rates with WPDES effluent limitations and Veolia Agreement effluent performance standards for Outfalls 001 and 002 at the SSWRF and JIWRF were maintained during wet weather events.

Exponent's analysis of Maintenance and Operational Readiness concluded that plant capacity was frequently reduced due to unavailable equipment. Exponent did not identify systemic deficiencies in Veolia's maintenance program as a cause of the unavailability. Our conclusions include:

- MMSD's C5 assets are, on average, five years past their estimated useful lives. Thus, many of the C5 assets are beyond their estimated useful lives and are at an elevated risk of failure, regardless of maintenance activities.
- We analyzed several assets with low availability that caused a reduction in plant capacity. We did not identify systemic deficiencies in Veolia's maintenance program as a cause of the equipment unavailability.
- We evaluated the Preventative Maintenance (PM) strategy for a limited sample of assets and found that Veolia's preventative maintenance schedule was based on, but did not consistently align with, Veolia's Standard Maintenance Procedures (SMP) and recommendations from the manufacturer. Exponent has not seen standard operating procedures (SOP) that define how Veolia creates the PM strategy or proposes and assesses maintenance deviations from the manufacturer's recommendations.
- Exponent evaluated Veolia's compliance with two requirements applicable to wet-weather events: (1) operating at design capacity unless restricted by Veolia's maintenance or Capital Repair/Replacement obligations; and (2) maximizing the volume of wastewater treated. Exponent assessed five wet-weather events during the evaluation period (2016-2026). The JIWRF reported reduced capacity during four of the five wet-weather events assessed. Each of the capacity reductions was the result of equipment outages. The reported reasons for equipment outages during these events were PM, Corrective Maintenance (CM), or Material Capital Repair or Replacement (MCRR) obligations, which are allowable reasons in the Agreement for capacity reductions. Therefore, Veolia met the contractual capacity requirements during the five wet-weather events analyzed. During four of the five events, JIWRF recorded influent flow rates greater than or equal to the plant's reported maximum capacity. Although influent flow data alone do not indicate

how flow was allocated within the facility's treatment and diversion pathways, the influent flow data indicate that Veolia maximized wet weather flows to the JIWRF during four of the five assessed CSOs.

- Between 2016 and 2026, Veolia completed 93% of PMs for C5 assets within 45 days, which is below the 95% goal.
- Exponent's examination of zero-cost work orders (those without any assigned labor or material cost) found that the relatively small quantity of zero-cost work orders was unlikely to affect overall work order closure statistics and did not indicate widespread failure to complete required maintenance activities. Of 33,662 work orders assessed, 250 (0.74%) were zero-cost work orders that lacked explanation. Many zero-cost work orders resulted from duplicate work, MCRR projects, or contractor-completed work.
- Exponent compared reported SSWRF and JIWRF capacities with reported equipment availability and identified one period, April 2022-April 2023 at the JIWRF, where WRFs reported full capacity and simultaneously reported insufficient equipment availability to meet the full capacity. It is Exponent's understanding that inconsistencies in manual updating of Veolia's internal Daily Equipment Status Reports contributed to this discrepancy. Except for the limited period of discrepancies, we did not find any systemic inaccuracies in Veolia's capacity reporting based on their internal documentation of available equipment.

This Executive Summary cannot capture all of Exponent's technical evaluation, analysis, and findings. Hence, the main body of this report is at all times the controlling document.

2 Background

Exponent was retained by Troutman Pepper Locke on behalf of Veolia Water Milwaukee, LLC (Veolia), to independently evaluate Veolia's performance under the Initial Agreement and Extension Agreement between Veolia and the Milwaukee Metropolitan Sewerage District (MMSD or the District) (together, the Agreement or the Veolia Agreement). Exponent's assignment included two components: (i) an Environmental Compliance Evaluation focused on compliance with the effluent limitations of MMSD's Wisconsin Pollutant Discharge Elimination System (WPDES) permit and the effluent performance standards in the Veolia Agreement; and (ii) a review of Maintenance and Operational Readiness, directed at the maintenance history and status of critical equipment within MMSD's wastewater system (the System) that is included in the Veolia Agreement. Exponent's work focused on the last ten (10) years (or, in some specific cases, shorter periods based on available documentation) and included determining whether Veolia performed activities in these two areas consistent with the obligations described in the Veolia Agreement.

2.1 WPDES Permit

MMSD is authorized by the Wisconsin Department of Natural Resources (WDNR) to discharge from the South Shore Water Reclamation Facility (SSWRF) and the Jones Island Water Reclamation Facility (JIWRF) and from combined sewer overflow (CSO) discharge points in accordance with permit requirements (WDNR 2019). There are two operable WPDES permits for the evaluation period: a WPDES permit effective January 8, 2013,[1] which was modified January 1, 2015 ("2015 WPDES permit"),[2] and a renewal permit issued April 1, 2019 ("2019 WPDES permit") [3] (WDNR 2015, 2019). The WPDES permit is in the process of being renewed, but as of the date of this report, the renewal is still pending with WDNR. The WPDES permits establish monitoring, operating, and reporting requirements for SSWRF and JIWRF and the combined sewer system. While MMSD is the permittee, the Veolia Agreement requires Veolia to manage the facilities, assist with monitoring, and support MMSD's reporting.

2.1.1 Effluent monitoring requirements

The WPDES permit establishes effluent limits and sampling and reporting frequencies for a range of water quality parameters at both SSWRF and JIWRF (WDNR 2019). At both facilities, the WPDES permit requires 24-hour flow proportional composite samples and grab samples to be collected from designated sampling points within the effluent channels after chlorination and dechlorination and prior to discharge (WDNR 2019).

Table 2 (see Section 3.2.1) lists the parameters to be monitored in SSWRF effluent daily sampling, including total 5-day biological oxygen demand (BOD_5), total suspended solids (TSS), chlorine, fecal coliform, phosphorus, pH, and total ammonia as nitrogen. Although sampled daily, results are reported as required by the WPDES permit, which includes calculated values for some parameters (e.g., monthly average values). The 2015 WPDES and 2019 WPDES permits require daily sampling of *E. coli* but there is no associated numerical limit (WDNR 2015, 2019). The 2015 WPDES permit also required continuous monitoring of flow rate, monthly metals testing,[4] annual acute and chronic whole effluent toxicity (WET) testing, and weekly temperature analysis (WDNR 2015). These parameters are monitored and reported but do not have associated numerical limits. The 2019 WPDES permit added quarterly arsenic

[1] WPDES Permit No. WI-0036820-03-0

[2] WPDES Permit No. WI-0036820-03-1

[3] WPDES Permit No. WI-0036820-04-0

[4] Total recoverable cadmium, chromium, copper, lead, nickel, zinc, and mercury. These parameters are sampled as 24-hour flow proportional composite samples except for mercury, which is collected as grab samples.

sampling, established a 4.1 ng/L mercury daily maximum limit (monthly sampling), and increased temperature monitoring to three times a week (WDNR 2019).[5]

Table 3 (see Section 3.2.1) lists the parameters to be monitored in JIWRF effluent daily sampling, including total BOD_5, TSS, chlorine, fecal coliform, phosphorus, and pH. The 2015 and 2019 WPDES permits both require daily sampling requirements for total ammonia as nitrogen and *E. coli*, but there are no associated numerical limits for *E. coli* (WDNR 2015, 2019). The 2015 WPDES permit required continuous monitoring of flow rate, monthly metals testing,[6] annual acute and chronic whole effluent toxicity (WET) testing, and weekly temperature analysis (WDNR 2015) but did not have associated numerical effluent limits. The 2019 WPDES permit added quarterly arsenic sampling, reduced the mercury daily maximum limit (monthly sampling) from 6.4 ng/L to 4.6 ng/L, and increased temperature analysis to three times a week (WDNR 2019).

2.1.2 Combined sewer system monitoring requirements

When wet weather peak flows exceed JIWRF secondary treatment capacity, flows from the ISS are required to receive treatment equivalent to primary treatment and disinfection prior to discharge (WDNR 2019). During high flow events, SSWRF is permitted to temporarily divert flow from the primary clarifiers to disinfection (i.e., bypassing aeration basins and final clarifiers) (WDNR 2019). MMSD is required to report CSO volumes and duration, and effluent discharged from SSWRF and JIWRF at Outfalls 001 and 002, respectively, is required to meet effluent limits (see Table 2 and Table 3 in Section 3.2.1) (WDNR 2019).

The WPDES permit allows CSO discharge events when necessary to prevent the ISS capacity from being exceeded but establishes CSO performance standards for MMSD. The WPDES permit requires either no more than six (6) CSO events[7] in a calendar year or treatment of no less than 85% of the annual wet weather combined sewage volume (WDNR 2019).[8]

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5 Effluent maximum temperature monitoring only required in 2022.

6 Total recoverable cadmium, chromium, copper, lead, nickel, zinc, and mercury. These parameters are sampled as 24-hour flow proportional composite samples except for mercury, which is collected as grab samples.

7 "A CSO event is defined as one or more overflows from a combined sewer system, resulting from a precipitation event that does not receive minimum treatment. Minimum treatment is defined as: (a) primary clarification…(b) solids and floatables disposal; and (c) disinfection." (WDNR 2019)

8 The annual wet weather combined sewage captured for treatment is calculated by dividing the total annual wet weather flow discharged at Jones Island and South Shore (total annual volume of flow discharged minus the total annual dry weather flow) by the sum of the total annual wet weather discharged and the total annual CSO volume.

The annual dry weather flow is calculated by annualizing the average of the ten lowest days of total influent at JIWRF and SSWRF.

2.2 Agreement Between Veolia and MMSD

Veolia and MMSD entered into an Initial Agreement for Operations and Maintenance Services on December 3, 2007, and an Extension Agreement on June 27, 2016, commencing on March 1, 2008 and March 1, 2018, respectively (MMSD and Veolia 2007, 2016, 2022, 2024a,b,c,d,e, 2025, 2026).[9] Together, these agreements and their associated schedules define the terms and conditions by which Veolia manages, operates, and maintains MMSD's wastewater system (the System), which includes the SSWRF, the JIWRF, the Metropolitan Interceptor Sewer (MIS) System, the Inline Storage System (ISS), and the Central Control System (CCS).

2.2.1 Environmental Compliance Requirements of the Veolia Agreement

Table 4 (see Section 3.2.1) sets forth the effluent performance standards for the System as specified in Table S2-1 to the Veolia Agreement and as amended over time. Effluent performance standards include requirements for BOD_5, TSS, phosphorus, total ammonia as nitrogen, and fecal coliform. The Veolia Agreement effluent performance standards are more stringent than the WPDES permit effluent limits for many parameters.

Performance requirements related to the WPDES permit are described in Section 2.2. Section 12.2.9 of the Veolia Agreement requires Veolia to meet WPDES permit effluent standards for total BOD_5, TSS, fecal coliform, total ammonia as nitrogen, and phosphorus on a weekly, monthly, six-month, or twenty-four month average, as applicable, and specifies that WPDES permit violations or failure to meet limits constitute a breach, "unless such failure is clearly recognized, justified or excused by the terms and conditions" of the Veolia Agreement.

2.2.2 Maintenance and Availability Requirements

2.2.2.1 Agreement Maintenance Requirements

Under the Veolia Agreement, Veolia must provide uninterrupted operation and maintenance of the System, which includes performing all Preventative Maintenance (PM), Predictive Maintenance (PdM), Corrective Maintenance (CM), and Capital Repairs or Replacements (CRR) in accordance with the Standards of Maintenance or Prudent Industry Practices (MMSD and Veolia 2007). Veolia is responsible for the means, methods, and techniques by which these practices are carried out (MMSD and Veolia 2007).

The Veolia Agreement defines the Standards of Maintenance and Prudent Industry Practices as the more stringent of the following maintenance requirements (MMSD and Veolia 2007):

[9] MMSD and Veolia amended the Veolia Agreement eight times as conditions changed. "Veolia Agreement" is inclusive of the Initial Agreement, Extension Agreement, and the eight Amendments.

a. Operation and Maintenance Manuals
b. Manufacturer's recommendations
c. Standard Maintenance Procedures (SMP)
d. Agreement, including Schedule 3
e. Prudent Industry Practices
f. Applicable laws

According to the Veolia Agreement (MMSD and Veolia 2007), Veolia must perform this maintenance such that:

a. Normal useful life of the equipment shall be achieved
b. Operational readiness of the equipment can be assumed
c. Existing redundant equipment shall remain available for operation at all times
d. All transport and delivery systems and meter systems on the System are maintained in a serviceable condition maximizing their life and functional purpose.

The Veolia Agreement also establishes certain maintenance performance metrics for work order (WO) completion (MMSD and Veolia 2016) (Figure 1). These requirements include closing 95% of PM and PdM work orders for Criticality 5 and higher assets within 45 days of the scheduled date.

In addition, Veolia is required to monitor other maintenance metrics, although the Veolia Agreement does not establish specific acceptance criteria for these metrics. These include the following (MMSD and Veolia 2007):

a. Backlog hours
b. Planned maintenance vs. unplanned maintenance
c. Percentage of CM by WO count
d. Percentage of CM by cost
e. Percentage of PdM by cost
f. Percentage of overtime hours
g. Percentage of CM identified through PM or PdM activities
h. Percentage of manpower utilization
i. Work order time-to-close statistics
j. Percentage of rotating equipment out of service and requiring repair

For PM and PdM:

Table S3-10a PM and PdM Metrics by Location	
Location	**Metrics**
Water Reclamation Facilities	At least ninety-five percent (95%) of all work orders scheduled for assets with a criticality score (as defined in OWAM) equal to 5 or higher shall be completed within 45 days of the scheduled date.

Figure 1 Minimum standards required by the Veolia Agreement for PM and PdM work orders (MMSD and Veolia 2016).

In addition to the WO metrics, the Veolia Agreement also defines PM schedules for basins, tanks, wet wells, and clarifiers at the SSWRF and JIWRF plants (Figure 2 and Figure 3).

Name	Drain, Clean and Inspect [1]	Other PM Activities[2]
Grit Tanks	Once per year	
Primary Clarifiers	Once every 2 years	
Aeration Basins	Once every 2 years	Remove floatables as necessary.
Secondary Clarifiers	Once every 2 years	
Chlorine Contact Basins	Once every 2 years	Remove floatables as necessary.
Pump Station Wet Wells	Once every 2 years	Inspect wet wells once every two (2) months, at a minimum, for accumulation of grit/floatables and promptly remove accumulated materials
Floatation Thickeners	Once every 2 years	
Digesters - Storage	Once during the Term	
Digesters – Anaerobic	Once during the term	

Note:

1. Minimum requirements, frequency shall be increased if necessary to properly operate and maintain the system. The PM shall include: drain or empty, clean and inspect for mechanical and structural condition and shall include all other PM activities to maintain the asset properly. The Company shall give notification to the District's Authorized Representative whenever a facility is removed from service.
2. Other PM related to Equipment associated with these facilities is covered under maintenance section in this Schedule 3.

Figure 2. Schedule for PM for select equipment for SSWRF (MMSD and Veolia 2007).

Name	Drain, Clean and Inspect [1]	Other PM Activities[2]
Grit Tanks	Once per year	
Primary Clarifiers	Once every 2 years	
Aeration Basins	Once every 2 years	Remove floatables as necessary.
Secondary Clarifiers	Once every 2 years	Cathodic protection shall be done in accordance with the SMP.
Chlorine Contact Basins	Once every 2 years	Remove floatables as necessary.
Pump Stations wet wells	Once every 2 years	Inspect wet wells once every two (2) months, at a minimum, for accumulation of grit/floatables and promptly remove accumulated materials
Equalization & Blend Tanks	Once every 2 years	
Silos (Interior)	Once during the Term within the first five Billing Years for each Silo	

Note:

1. Minimum requirements, frequency shall be increased if necessary to properly operate and maintain the system. The PM shall include: drain or empty, clean and inspect for mechanical and structural condition and shall include all other PM activities to maintain the asset properly. The Company shall give notification to the District's Authorized Representative whenever a facility is removed from service.
2. Other PM related to Equipment associated with these facilities is covered under maintenance section in this Schedule 3.

Figure 3. Schedule for PM for select equipment for JIWRF (MMSD and Veolia 2007).

Plant equipment is owned and administered by MMSD. MMSD initially estimates the useful lives of the equipment assets (MMSD 2015) and assesses the condition, reliability, and performance of equipment assets periodically through their lifetimes (MMSD 2016). Veolia is responsible for operating and maintaining the equipment, which includes condition assessments. Capital repairs or replacements with a cost greater than $25,000 are defined as Material Capital Repairs or Replacements (MCRR), and the cost of MCRR is the responsibility of MMSD.[10] Veolia is responsible for providing justification for MCRR and recommending equipment to procure (MMSD and Veolia 2007).

2.2.2.2 Availability Requirements

Equipment and system availability are not explicitly defined in the Veolia Agreement. Availability is a common industry term describing the percentage of time equipment is ready to perform its intended function when it is called upon (Smith 2011). Equipment is generally termed "available" when it is able to perform its intended function within specified operating conditions (Smith 2011). Equipment is "unavailable" if it is not ready to be called upon for its intended use, such as when (i) it is down for maintenance (scheduled or unplanned), (ii) it is operating outside of specifications, or (iii) it is otherwise inoperable.

Availability can also be assessed at the system level. A system is available if (i) its required[11] sub-systems are available, and (ii) the system is ready to perform within its specified operating

[10] This threshold was originally $10,000 per the Veolia Agreement, but this threshold increased in approximately 2022 to $25,000 (MMSD and Veolia 2007, 2016; MMSD and Veolia 2023, pers. comm.). If Veolia is deemed to be at fault for a failure leading to a capital repair or replacement, then Veolia is responsible for the cost regardless of level.

[11] "Required" in this sense is different from MMSD's and Veolia's Criticality score.

conditions. Unavailability (all or partial) of at least one required sub-system will reduce the capacity of the System and make it not fully available. Therefore, system availability is typically determined by the necessary sub-systems(s) with the lowest availability.

The Veolia Agreement requires equipment, including redundant equipment, to remain available at all times (MMSD and Veolia 2007) (emphasis added):

> *[Veolia] shall perform, in a timely, effective and efficient manner, all maintenance, including PM, PdM and CM, Capital Repairs or Replacements and, subject to Section 3.16.2, Material Capital Repairs or Replacements…such that (a) the normal useful life of the equipment shall be achieved,* ***(b) operational readiness of the same can be assumed, (c) existing redundant Equipment shall be maintained to remain available for operations at all times*** *and (d) all transport and delivery systems and meter systems on the system are maintained in a serviceable condition maximizing their life and functional purpose.*

Although adequate redundancy can allow the system to remain fully available while individual equipment is out of service, redundant equipment itself cannot remain available at all times. For example, a redundant unit may be unavailable when scheduled maintenance is being performed. Design guidance for wastewater treatment facilities therefore typically recommends that redundant equipment be available when needed – such as when primary equipment is out of service – rather than available at all times (GLUMRB 2014; U.S. EPA 1973). For this reason, Exponent considers system availability (full vs. partial) to be a more pertinent performance metric than availability of redundant equipment when it is not required for operation.

Veolia is also required to obtain written approval from MMSD prior to intentionally reducing capacity of the WRFs below Design Capacity. Acceptable causes of capacity reduction include Veolia's maintenance or Capital Repair/Replacement obligations (MMSD and Veolia 2007, 2016). In practice, Veolia also reduces capacity as the result of State Point Analysis[12] to comply with effluent performance standards. The Design Capacity of JIWRF is 330 million gallons per day (MGD) peak flow and 390 MGD with diversions. The Design Capacity of SSWRF is 300 MGD peak flow (MMSD and Veolia 2007, 2016). Veolia communicates changes in the available capacity of the WRFs with the District by sending documents called "Capacity Faxes" that list equipment constraints.

During wet weather events, Veolia is required to operate the plants to maximize conveyance and treatment and is permitted to operate the plants beyond their design rated capacities. Veolia is

[12] State Point Analysis is a steady-state graphical method used to evaluate secondary clarifier performance by considering hydraulic capacity and solids loading.

also required to prepare standard operating procedures (SOPs) for operation of the plants during wet weather events (MMSD and Veolia 2007, 2016).

3 Targeted Wastewater Compliance Evaluation

Exponent's targeted wastewater compliance evaluation found Veolia to be in substantive compliance with both the WPDES permit and the effluent performance standards of the Veolia Agreement.

Veolia's compliance with requirements for sample collection, effluent water quality, and overflows and bypasses (January 2016–June 2026) is discussed in detail in Sections 3.1 and 3.2.

3.1 Sample Collection and Reporting

For most water quality parameters, Veolia is responsible for collecting the compliance samples required by both the WPDES permit and the Veolia Agreement. MMSD takes custody of the samples and is responsible for laboratory analysis and WDNR reporting. MMSD shares sample results with Veolia via the Water Information Management System (WIMS) database.[13] According to the Veolia Agreement, exceptions are pH and total residual chlorine (TRC) samples, which Veolia analyzes in the field and reports to MMSD.[14]

Exponent evaluated Veolia's compliance with the SSWRF and JIWRF effluent sample collection requirements by evaluating information included in the WIMS database for the period of January 2016–June 2026. Exponent confirmed that Veolia collected one or more samples at SSWRF and JIWRF on each of the 3,834 days of the period, and the WIMS database includes >99.9% of the analytical results for the effluent parameters required by the WPDES permit.[15]

Veolia's collection of samples required by the WPDES permit was found to be in compliance with the requirements of the Veolia Agreement. In addition, Veolia collects samples for metals testing on a weekly basis, which exceeds the WPDES permit sampling frequency of monthly.

3.2 Effluent Compliance Evaluation

Exponent evaluated effluent compliance with respect to WPDES permit effluent limits and Veolia Agreement effluent performance standards. Table 1 summarizes requirements for

[13] Effluent data were obtained through a backup copy of the Water Information Management System (WIMS) database that Veolia uses to access data uploaded by MMSD.

[14] Veolia indicates that quarterly arsenic and annual toxicity test samples are collected by MMSD; these parameters are not evaluated here.

[15] Exponent was not able to confirm the specific reasons for the minor instances of missing test data (<0.1%) from the WIMS database. However, Veolia has informed Exponent that data may be omitted from the WIMS database when sample and/or laboratory issues are identified by MMSD.

constituents that have both WPDES permit effluent limits and Veolia Agreement effluent performance standards. The complete list of WPDES permit limits for SSWRF and JIWRF are presented in Table 2 and Table 3, respectively.

Table 1. WPDES permit effluent limits and Veolia Agreement effluent performance standards

			WPDES permit		Veolia Agreement	
Parameter	**Sample Type**	**Limit Type**	**Effective date range**	**Limit**	**Effective date range**	**Limit**
SSWRF	Total BOD_5	Monthly average	1/1/13–present	30 mg/L	12/3/2007–12/31/2023	15 mg/L
					1/1/2024–present	20 mg/L
	TSS	Monthly average	1/1/13–present	30 mg/L	12/3/2007–present	15 mg/L
	Phosphorus	Monthly average			12/3/2007–6/26/2016	1.0 mg/L
		24-month rolling average[a]	5/1/15–3/31/19	0.6 mg/L	6/27/2016–7/31/2022	0.6 mg/L
		6-month average[b]	1/8/13–3/31/19	0.8 mg/L	6/27/2016–7/31/2022	0.8 mg/L
		6-month average[b]	4/1/19–present	0.7 mg/L	8/1/2022–5/19/2024	0.7 mg/L
		Monthly average	4/1/19–present	1.0 mg/L	8/1/2022–5/19/2024	0.9 mg/L
		Monthly average			5/20/2024–present	1.0 mg/L
	Total Ammonia as Nitrogen	Monthly average[c]	4/1/19–present	27 mg/L	12/3/2007–present	5.0 mg/L
	Fecal Coliform	Geometric mean	1/1/13–present	400 No. /100 mL	12/3/2007–7/31/2022	100 No. /100 mL
		Geometric mean			8/1/2022–present	200 No. /100 mL
JIWRF	Total BOD_5	Monthly average	1/1/13–present	30 mg/L	12/3/2007–present	15 mg/L
	TSS	Monthly average	1/1/13–present	30 mg/L	12/3/2007–present	15 mg/L
	Phosphorus	Monthly average	1/1/13–present	0.66 mg/L	12/3/2007–present	0.5 mg/L
	Fecal Coliform	Geometric mean	1/1/13–present	400 No. /100 mL	12/3/2007–7/31/2022	100 No. /100 mL
		Geometric mean			8/1/2022–present	200 No. /100 mL

Sources: WDNR 2015, 2019; MMSD and Veolia 2007, 2016, 2022, 2024c

Notes: BOD_5 - 5-day biochemical oxygen demand TSS - total suspended solids
No./100 mL - number per one hundred milliliters mg/L - milligrams per liter

[a] 24-month rolling average evaluated each month
[b] 6-month average (evaluated May to October and November to April)
[c] Year-round monitoring. WPDES limit effective November – April

3.2.1 Compliance with WPDES effluent limitations at Outfalls 001 and 002

Table 2 and Table 3 summarize effluent limitations and sample results at SSWRF and JIWRF, respectively, for total BOD_5, TSS, chlorine, fecal coliform, phosphorus, pH, total ammonia as nitrogen, and mercury, as applicable at each facility.

The overall rate of compliance, computed as the number of samples in compliance divided by the total number of samples shown in Table 2 and Table 3, was 99.97% for SSWRF and 99.94% for JIWRF.

Table 2. SSWRF (Outfall 001) WPDES permit monitoring requirements, effluent limits, and compliance history (January 2016–June 2026)

Parameter	Sample Type	Effective date range	Limit Type	Limit	Percent of samples in compliance	Samples in compliance out of total samples
Total BOD_5	24-hour flow proportional composite	1/1/13–present	Monthly average	30 mg/L	100%	126/126
			Weekly average	45 mg/L	100%	548/548
TSS	24-hour flow proportional composite	1/1/13–present	Monthly average	30 mg/L	100%	126/126
			Weekly average	45 mg/L	99.8%	547/548
TRC	Grab	1/1/13–present	Daily maximum	38 µg/L	99.97%	3,833/3,834
			Weekly average	36 µg/L	100%	548/548
		4/1/19–present	Monthly average	36 µg/L	100%	87/87
Fecal Coliform	Grab	1/1/13–present	Geometric mean	400 No./100 mL	100%	126/126
		4/1/19–present	Weekly geometric mean	972 No./100 mL	100%	379/379
Total Phosphorus	24-hour flow proportional composite	1/8/13–3/31/19	6-month average[a]	0.8 mg/L	100%	6/6
		5/1/15–3/31/19	24-month rolling average[b]	0.6 mg/L	100%	39/39
		4/1/19–present	Monthly average	1.0 mg/L	100%	87/87
		4/1/19–present	6-month average[a]	0.7 mg/L	100%	15/15
pH Field	Grab	1/1/13–present	Daily maximum	9.0 su	100%	3,834/3,834
			Daily minimum	6.0 su	100%	
Total Ammonia as Nitrogen	24-hour flow proportional composite	1/1/13–present[c]	Daily maximum	27 mg/L	100%	3,834/3,834
		4/1/19–present[c]	Weekly average	27 mg/L	100%	378/378
		4/1/19–present[c]	Monthly average	27 mg/L	100%	87/87

Table 2. Cont. SSWRF (Outfall 001) WPDES permit monitoring requirements, effluent limits, and compliance history (January 2016–June 2026)

Parameter	Sample Type	Effective date range	Limit Type	Limit	Percent of samples in compliance	Samples in compliance out of total samples
Mercury	Grab	4/1/19–present	Daily maximum	4.1 ng/L	97.7%	85/87

Sources: WDNR 2015, 2019, data from the WIMS database

Notes: BOD_5 - 5-day biochemical oxygen demand; TRC - total residual chlorine; No./100 mL - number per one hundred milliliters; su - standard units; TSS - total suspended solids; mg/L - milligrams per liter; µg/L - micrograms per liter; ng/L - nanograms per liter

[a] 6-month average (evaluated May to October and November to April)
[b] 24-month rolling average evaluated each month
[c] Year-round monitoring. WPDES limit effective November – April

Table 3. JIWRF (Outfall 002) WPDES permit monitoring requirements, effluent limits, and compliance history (January 2016–June 2026)

Parameter	Sample Type	Effective date range	Limit Type	Limit	Percent of samples in compliance	Samples in compliance out of total samples
Total BOD_5	24-hour flow proportional composite	1/1/13–present	Monthly average	30 mg/L	100%	126/126
			Weekly average	45 mg/L	100%	548/548
TSS	24-hour flow proportional composite	1/1/13–present	Monthly average	30 mg/L	100%	126/126
			Weekly average	45 mg/L	99.8%	547/548
	Calculated	4/1/19–present	Weekly average[a]	51,332 lbs/day	100%	223/223
			Weekly average[b]	56,832 lbs/day	100%	28/28
			Weekly average[c]	53,043 lbs/day	100%	127/127
			Monthly average[a]	30,195 lbs/day	100%	50/50
			Monthly average[b]	33,430 lbs/day	100%	7/7
			Monthly average[c]	31,202 lbs/day	100%	30/30
TRC	Grab	1/1/13–present	Daily maximum	38 µg/L	99.9%	3,831/3,834
			Weekly average	36 µg/L	100%	548/548
		4/1/19–present	Monthly average	36 µg/L	100%	87/87
Fecal Coliform	Grab	1/1/13–present	Geometric mean	400 No./100 mL	100%	126/126
		4/1/19–present	Weekly geometric mean	972 No./100 mL	100%	379/379

Table 3. Cont. JIWRF (Outfall 002) WPDES permit monitoring requirements, effluent limits, and compliance history (January 2016–June 2026)

Parameter	Sample Type	Effective date range	Limit Type	Limit	Percent of samples in compliance	Samples in compliance out of total samples
Total Phosphorus	24-hour flow proportional composite	1/1/13–present	Monthly average	0.66 mg/L	100%	126/126
		1/1/13–3/31/19	6-month average[d]	0.22 mg/L	67%	4/6
	Calculated	4/1/19–present	Monthly average[a]	664 lbs/day	100%	50/50
			Monthly average[b]	735 lbs day	100%	7/7
			Monthly average[c]	686 lbs/day	100%	30/30
pH Field	Grab	1/1/15–present	Daily maximum	9.0 su	100%	3,834/3,834
			Daily minimum	6.0 su		
Mercury	Grab	1/1/13–present	Daily maximum	6.4 ng/L	100%	39/39
		4/1/19–present		4.6 ng/L	98.9%	86/87

Sources: WDNR 2015, 2019, data from the WIMS database

Notes:
BOD_5 - 5-day biochemical oxygen demand
TRC - total residual chlorine
No./100 mL - number per one hundred milliliters
su - standard units
lbs/day - pounds per day
TSS - total suspended solids
mg/L - milligrams per liter
µg/L - micrograms per liter
ng/L - nanograms per liter

[a] Effective in the following months: January, March, May, July, August, October, and December
[b] Effective in February
[c] Effective in the following months: April, June, September, and November
[d] 6-month average (evaluated May to October and November to April)

At SSWRF, permit effluent limits that were not met during the evaluation period (January 2016-June 2026) included:

- One (1) result for total residual chlorine (daily maximum) in February 2019.
- Two (2) results for mercury (daily maximum) in March 2023 and September 2023.
- One (1) result for TSS (weekly average) in August 2025.

At JIWRF, permit effluent limits that were not met during the evaluation period (January 2016-June 2026) included:

- One (1) result for TSS (weekly average) in February 2018.
- Three (3) results for total residual chlorine (daily maximum) in August 2017, October 2017, and February 2018.
- Two (2) results for total phosphorus (6-month average) in October 2016 and April 2017.

- One (1) result for mercury (daily maximum) in May 2022.

3.2.2 Compliance with Veolia Agreement effluent performance standards at Outfalls 001 and 002

Schedule 2, Table S2-1 of the Veolia Agreement includes effluent performance standards for BOD_5, TSS, phosphorus, total ammonia as nitrogen, and fecal coliform at the SSWRF (Outfall 001) and the JIWRF (Outfall 002). Exponent utilized effluent data for these outfalls obtained from the WIMS database (January 2016–June 2026) to evaluate Veolia's performance relative to the effluent performance standards. Both the effluent performance standards and Veolia's compliance with these standards are summarized in Table 4.

The overall rate of compliance with the Veolia Agreement effluent performance standards, computed as the number of samples in compliance divided by the total number of samples shown in Table 4, was 95.82% for SSWRF and 99.68% for JIWRF.

Table 4. Veolia Agreement effluent performance standards and compliance history for SSWRF and JIWRF (January 2016–June 2026)

Plant	Parameter	Effective date range	Limit Type	Limit	Percent of samples in compliance	Samples in compliance out of total samples
SSWRF	Total BOD_5	12/3/2007–12/31/2023	Monthly average	15 mg/L	88.5%	85/96
		1/1/2024–present	Monthly average	20 mg/L	93.3%	28/30
	TSS	12/3/2007–present	Monthly average	15 mg/L	96.0%	121/126
	Phosphorus	12/3/2007–6/26/2016	Monthly average	1.0 mg/L	100%	6/6
		6/27/2016–7/31/2022	24-month rolling average[a]	0.6 mg/L	100%	73/73
		6/27/2016–7/31/2022	6-month average[b]	0.8 mg/L	100%	12/12
		8/1/2022–5/19/2024	6-month average[b]	0.7 mg/L	100%	4/4
		8/1/2022–5/19/2024	Monthly average	0.9 mg/L	100%	22/22
		5/20/2024–present	Monthly average	1.0 mg/L	100%	25/25
	Total Ammonia as Nitrogen	12/3/2007–present	Monthly average	5.0 mg/L	96.8%	122/126
	Fecal Coliform	12/3/2007–7/31/2022	Geometric mean	100 No./100 mL	94.9%	75/79
		8/1/2022–present	Geometric mean	200 No./100 mL	97.9%	46/47
JIWRF	Total BOD_5	12/3/2007–present	Monthly average	15 mg/L	100%	126/126
	TSS	12/3/2007–present	Monthly average	15 mg/L	99.2%	125/126
	Phosphorus	12/3/2007–present	Monthly average	0.5 mg/L	99.2%	125/126
	Total Ammonia as Nitrogen	12/3/2007–present	Monthly average	5.0 mg/L	100%	126/126
	Fecal Coliform	12/3/2007–7/31/2022	Geometric mean	100 No./100 mL	100%	79/79
		8/1/2022–present	Geometric mean	200 No./100 mL	100%	47/47

Sources: MMSD and Veolia 2007, 2016, 2022, 2024c, data from the WIMS database

Notes: BOD_5 - 5-day biochemical oxygen demand; TSS - total suspended solids; No./100 mL - number per one hundred milliliters; mg/L - milligrams per liter

[a] 24-month rolling average evaluated each month
[b] 6-month average (May to October and November to April)

At SSWRF, Veolia Agreement effluent performance standards that were not met during the evaluation period (January 2016-June 2026) include:

- Thirteen (13) results for BOD_5 (monthly average) between July 2017 and December 2025.[16]
- Five (5) results for TSS (monthly average) between July 2017 and December 2025.[17]
- Four (4) results for total ammonia as nitrogen (monthly average) between July 2017 and November 2025.[18]
- Five (5) results for fecal coliform (geometric mean) between July 2017 and August 2023.[19]

At JIWRF, Veolia Agreement effluent performance standards that were not met during the evaluation period (January 2016-June 2026) include:

- One (1) result for total phosphorus (monthly average) in October 2023.
- One (1) result for TSS (monthly average) in February 2018.

3.2.3 Combined Sewer Overflows

As noted in Section 2.1.2, MMSD's WPDES permit requires either six or fewer CSO events per year or treatment of no less than 85% of the annual wet weather combined sewage volume.[20] Exponent reviewed documents and data provided by Veolia, including CCS overflow forms, Veolia's monthly reports to MMSD, CSO discharge volumes extracted from the WIMS database, and documents from MMSD, including Combined Sewer Overflow Annual Notices and Combined Sewer Overflow Event Five-Day Notification Letters, to assess the number and volume of CSO events between January 2016 and June 2026.

As shown in Table 5, the annual number of CSO events ranged from zero (0) to six (6) for calendar years 2016-2025 and for the partial year of January-June 2026.

[16] BOD_5 monthly average exceedances occurred in: July 2017, February 2019, June 2021, December 2021, January 2022, February 2023, May–August 2023, October 2023, October 2024, and December 2025.
[17] TSS monthly average exceedances occurred in: July 2017, August 2023, October 2023, August 2025, and December 2025.
[18] Ammonia monthly average exceedances occurred in: July 2017, August 2017, October 2024, and November 2025.
[19] Fecal coliform geometric mean exceedances occurred in: July 2017, August 2018, October 2019, August 2021, and August 2023.
[20] Veolia and MMSD have separate responsibilities regarding overflows and bypasses as detailed in the Veolia Agreement. MMSD is responsible for making final determinations for these events.

Table 5. Summary of CSO events from January 2016 through June 2026

Year	Number of CSO Events	CSO Event Dates	Estimated Discharge (MG)
2016	2	Aug 30, Sep 7-8	109[a]
2017	0	No CSO events	No discharge
2018	6	Jun 18–19, Jul 4, Aug 20–21, Aug 27–29, Sep 5–6, Oct 1–3	1272
2019	2	Mar 14–16, Sep 13–14	562
2020	2	May 17–19, Jul 10	2,107
2021	2	**Aug 8–10**, Sep 13	380
2022	1	Sep 11–13	751
2023	1	**Feb 27–Mar 1**	230
2024	1	**Apr 2–4**	357
2025	1	**Aug 9–13**	5,010
2026	1	**Apr 14–19**	2,700

Sources: CCS overflow forms and Veolia Monthly Reports to MMSD from January 2016–June 2026, data from the WIMS database, MMSD 2018a,b,c,d,e, 2021a,b, 2024a,b, 2025, 2026a,b

Notes: MG - million gallons
-- - No estimated discharge data found for 2016
Discharge volumes rounded to the whole MG
Bold dates denote the five CSO events discussed in more detail in Section 4.4.1.1

[a] Veolia's Monthly Report to MMSD for September 2016 reported MMSD's estimated overflow discharge volume of 109 MG. The August 2016 report did not report an overflow event or an estimated discharge volume.

4 Targeted Operational Compliance Evaluation

Exponent reviewed Veolia's equipment maintenance and operational readiness against the requirements of the Veolia Agreement. One objective was to evaluate the preventative maintenance (PM) of major equipment assets at the JIWRF and SSWRF. The review primarily focused on Criticality Level 5 (C5) and higher equipment assets, and other equipment that may impact capacity.[21] MMSD has categorized 957 equipment assets at the JIWRF and SSWRF as C5.[22] Equipment types include sensors and detectors, major equipment items like tanks, and certain utilities. The collection and conveyance systems outside these two facilities were not included in Exponent's review.

[21] Criticality level 5 is the highest level and includes the assets most critical to operation of the SSWRF and JIWRF.

[22] Critical-5 Assets

Exponent's review utilized the following information sources provided by Veolia:

- Equipment availability reports
- Work order metrics reported monthly to MMSD
- Capacity limitation memos ("capacity faxes") to MMSD
- Oracle Work and Asset Management (OWAM) replicated work order database (including MCRR) 2016 – January 2024
- Veolia Asset Management System (VAMS) replicated work order database (including MCRR) May 2024 – August 2026
- MCRR request history 2008 – 2026
- Maintenance program documents including operating and maintenance (O&M) manuals and Veolia's PM schedules
- Critical equipment list
- Agreements
- Plant process flow diagrams

Exponent's review was structured into three primary analytical tasks:

Work Order Metrics Analysis

- Summarize PM work order closure rate for C5 and higher assets
- Analyze zero-cost work orders to determine whether zero-cost work orders affected closure statistics

Equipment and Systems Analysis

- Assess estimated useful life of C5 assets
- Assess availability of major equipment systems 2018-2026, with focus on equipment that cause capacity limits
- Assess PM of low-availability assets relative to Standards of Maintenance and Prudent Industry Practices in the Veolia Agreement (MMSD and Veolia 2007)

Capacity Analysis

- Assess 2016-2026 JIWRF and SSWRF capacity faxes
- Compare capacity faxes to equipment availability
- Wet weather events
    - Assess plant capacity and influent flow during select CSO events

4.1 Work Orders Analysis

Veolia managed its work orders through OWAM from at least January 2016 until early 2024, and since then, Veolia has managed work orders through its Veolia Asset Management System (VAMS). A migration between the two asset management systems occurred from January 31, 2024 through April 30, 2024. Because it was unclear which database (i.e., OWAM or VAMS) most accurately reflected WO closure rates in this transition window, Exponent excluded this time frame, which corresponds to approximately 2.3% of the time between January 2016 and August 2026.

An individual work order may be composed of several tasks (called Activities) assigned to different trades or crafts, e.g., pipefitter or instrumentation. Exponent received two files containing the replicated OWAM and VAMS work order databases from January 2016 to August 2026.[23] These databases contained a combined approximately 275,000 Activities (for preventative maintenance, reactive, capital, and miscellaneous). Additionally, Exponent received a replicated MCRR work order database[24] and a replicated MCRR request database. Once an MCRR is approved, work orders are generated for each MCRR and tracked in the OWAM or VAMS system.

4.1.1 PM Work Order Metrics Analysis

Exponent understands that the Veolia Agreement requires at least 95% completion for PM of C5 or higher assets within 45 days after the scheduled date (MMSD and Veolia 2016).[25] A summary of Exponent's findings related to PM completions for C5 and higher assets is shown in Table 6. Based on the replicated databases, Exponent found that Veolia completed 93% of PMs for C5 and higher assets within 45 days. For years with a complete dataset (i.e., 2016-2023, 2025), Exponent found that Veolia met the 45-day 95% completion target for C5 and higher assets in 7 of the 9 years.

Exponent arrived at this summary by filtering and analyzing the databases provided by Veolia following a similar methodology that Veolia reportedly uses for reporting metrics to MMSD. To summarize, Exponent removed duplicate work orders from each replicated database, removed work orders that are not PM, removed work not assigned to crews that performed work at JIWRF and SSWRF, considered the "Required By" date as the start date for completion, and considered the "Completed By" date as the end date for completion. Exponent focused on completion

[23] Exponent was provided two spreadsheets that were exported by Veolia: <MKE data pull 8-24-26.xlsx>, <WO AND HISTORY TABLE COMBINED TEST 5 no duplicates add Material _2210724_1.csv>.

[24] MCRR Work Order List VAMS, MCRR SA WORK ORDER, MCRR SA WORK HISTORY.

[25] Exponent was able to reconcile both the replicated OWAM and VAMS databases for C5 and higher assets relative to metrics reported by Veolia for 2023 (OWAM) and May 2024 through October 2025 (VAMS) in terms of completion percentage within 45 days and total number of work orders.

percentages between January 2016 and January 2024 for OWAM, and after May 2024 for VAMS. For 2026, Exponent only evaluated "Required By" dates between January 1, 2026, and April 30, 2026, and "Completed By" through August 20, 2026.

Table 6. Summary of Veolia's completion percentage within 45 days for C5 and higher assets by year.

Replicated Database Provided To Exponent	Year	Completion % Within 45 Days	Number of Work Orders Completed Within 45	Total Number of Work Orders
OWAM (Jan 1, 2016-Jan 31, 2024)	2016	83%	1,796	2,163
	2017	80%	2,040	2,538
	2018	95%	2,509	2,638
	2019	97%	2,427	2,495
	2020	97%	2,095	2,151
	2021	97%	2,113	2,187
	2022	96%	2,173	2,252
	2023	96%	2,089	2,168
	2024[a]	92%	157	170
VAMS (May 1, 2024-August 20, 2026)	2024[b]	95%	1,138	1,198
	2025	96%	1,778	1,854
	2026[c]	92%	554	599
	Total	**93%**	**20,869**	**22,413**

[a]Data range is from January 1, 2024, through January 31, 2024.
[b]Data range is from May 1, 2024, through December 31, 2024.
[c]Data range is from January 1, 2026, through April 30, 2026, for "Required By" and includes completion dates through August 20, 2026.

4.1.2 Zero-Cost Work Orders Assessment

Exponent evaluated Veolia's work orders for the SSWRF and JIWRF facilities between 2016 and 2026 to assess (i) the total number of work orders closed with zero cost, (ii) the apparent reason these work orders were closed (e.g., duplicate, work complete, etc.), and (iii) work orders with low labor manhours.

Exponent defined a "work order activity" as each individual line item contained in Veolia's work order records.[26] A "unique work order" was defined as a consolidation of all of the work order activities identified by the same work order number. For example, WO #1700162, which documented PM for Dryer Burner #1, is a unique work order containing 222 work order

[26] C5 Asset Maintenance History VAMS, CRIT 5 SA WORK HISTORY, CRIT 5 SA WORK ORDER.

activities with labor costs for 14 crafts, including electrical, operations & maintenance, utilities, and contractors.[27]

Table 7 summarizes work order information provided by Veolia for its C5 equipment during the period from January 1, 2016, through July 14, 2026. Of the 235,673 activities listed in the replicated databases, a total of 163,767 had both labor and material costs entered (i.e., neither labor nor material cost was left blank). Exponent identified 3,386 out of 163,767 work order activities, or 2.1%, that lacked either an associated labor hours entry or a material costs entry, referred to hereafter as a "zero-cost work order," which mapped to 1,236 (3.7%) unique zero-cost work orders out of the corresponding 33,662 unique work orders.

Exponent then compared the 1,236 unique zero-cost work orders with work orders transferred to the replicated MCRR work order database[28] and identified 617 that were transferred to the MCRR list, and that therefore had costs assumed by MMSD, which left 619 unique zero-cost work orders, or 1.8% of the 33,662 unique work orders analyzed.

Table 7. Summary of C5 work order activities and unique work orders provided by Veolia between January 2016 and July 2026

	Work Order Activities	Unique Work Orders
Total	235,673	36,651
Total Containing Labor + Material Cost Information	163,767	33,662
Zero Labor and Material Cost	3,386	1,236
Transferred to MCRR work order database	-	617
Remaining zero-cost work orders	-	619

A qualitative review of the work order comments provides context for closing the remaining 619 unique work orders. Table 8 summarizes Exponent's qualitative review of these zero-cost work orders, which revealed that approximately 250 closed work orders (< 0.8% of unique work orders) either had no comments or minimal information describing why they were marked complete (e.g., "Complete"). Table 8 also summarizes other comments in the work order databases[29] that provided reasons for closing zero-cost work orders. These explanations included the creation of work orders that were opened and marked complete to allow invoicing to contractors, those that were duplicated and completed under different work order numbers, and smaller scale PM tasks that were marked as completed when systems were noted to be operational.

[27] CRIT 5 SA WORK HISTORY.
[28] MCRR Work Order List VAMS, MCRR SA WORK ORDER, MCRR SA WORK HISTORY.
[29] C5 Asset Maintenance History VAMS, CRIT 5 SA WORK HISTORY, CRIT 5 SA WORK ORDER.

Because the number of unexplained zero-cost work orders is small, they do not appear to impact overall work order closure statistics or indicate widespread failure to complete required maintenance activities.

Table 8. Sample of apparent reasons for closing zero-cost work orders, according to comments entered by Veolia for individual work order tasks

Exponent Assignment	Comment Type	Number of WO	Comment Example
Unexplained zero-cost WO	None	125	
	Complete	125	Completed as per task (WO #1214560)
Explained zero-cost WO	Completed by contractor	133	Work complete, this work order was to pay for the FIKE service in 2024 (WO #1244334)
	Duplicate	65	OVERLAP – Work completed under AN PM WO #1444389 (WO #1444390)
	Operational	20	Eyewash/shower works properly (WO #1351946)

Exponent's analysis of both the individual work order activities and consolidated unique work orders indicated:

1. Work orders for PM activities required at multiple time intervals (e.g., monthly, biannual) were sometimes consolidated within one unique work order number.
2. A small percentage (1.8%) of unique work orders marked as completed had no associated labor or material costs, and fewer unique work orders (< 0.8%) had insufficient detail to determine the reason for their closure. Similarly, 2.1% of zero-cost work order activities had no associated labor or material costs.

4.2 Equipment and Systems Analysis

Exponent analyzed how Veolia's maintenance of equipment impacted the availability of key assets that can limit the capacity of SSWRF and JIWRF. First, Exponent evaluated the remaining useful life of C5 equipment to determine how "aged" these assets currently are at SSWRF and JIWRF. Then, Exponent performed an availability analysis to identify key equipment or systems with the lowest relative availability that could impact the capacity of SSWRF and JIWRF. After selecting these assets, Exponent analyzed whether the current maintenance strategy for these assets met the Standards of Maintenance and Prudent Industry Practices (MMSD and Veolia 2007). Finally, Exponent evaluated whether age, maintenance, or other factors contributed to reduced availability of the equipment or systems.

4.2.1 Estimated Useful Life of C5 Assets

Exponent assessed the average remaining useful life for C5 assets at JIWRF and SSWRF as a frame of reference for PM and PdM analysis. Equipment reliability (and the associated likelihood of CM) generally follows a "Bathtub Curve" (see Figure 4). The "Bathtub Curve" can be characterized in three reliability windows: (1) high rate of early failures just after installation, (2) low and random rate of failures throughout useful life, and (3) increased rate of failures during a wear-out phase near end of life (Ohring 1995). Of the 957 C5 assets, 389 had estimated useful lifetimes in the provided documentation and are used in the analysis in this section. For these C5 assets with estimated useful lifetimes, 97 (25%) were within their useful life, while 87 (22%) were 12 or more years past their estimated useful lifetimes. Exponent found that the C5 assets with provided useful life were approximately 5 years beyond their estimated useful life on average (Figure 5). Thus, many of the C5 assets are at an elevated risk of failure irrespective of ongoing PM.

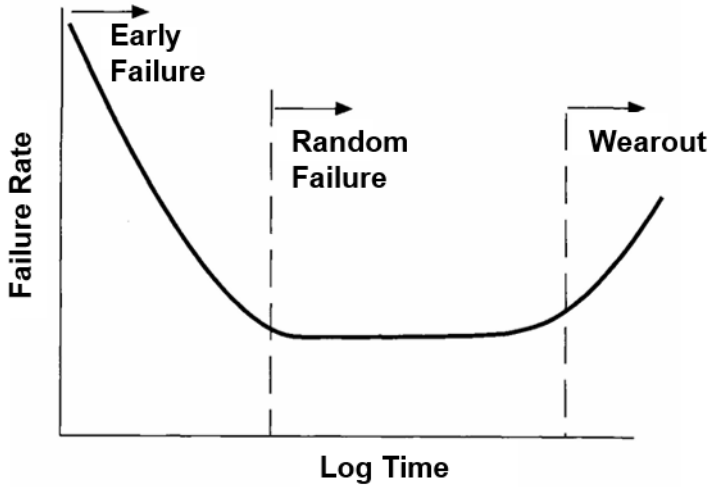


Figure 4. Example of a "Bathtub Curve" (derived from Ohring 1995).

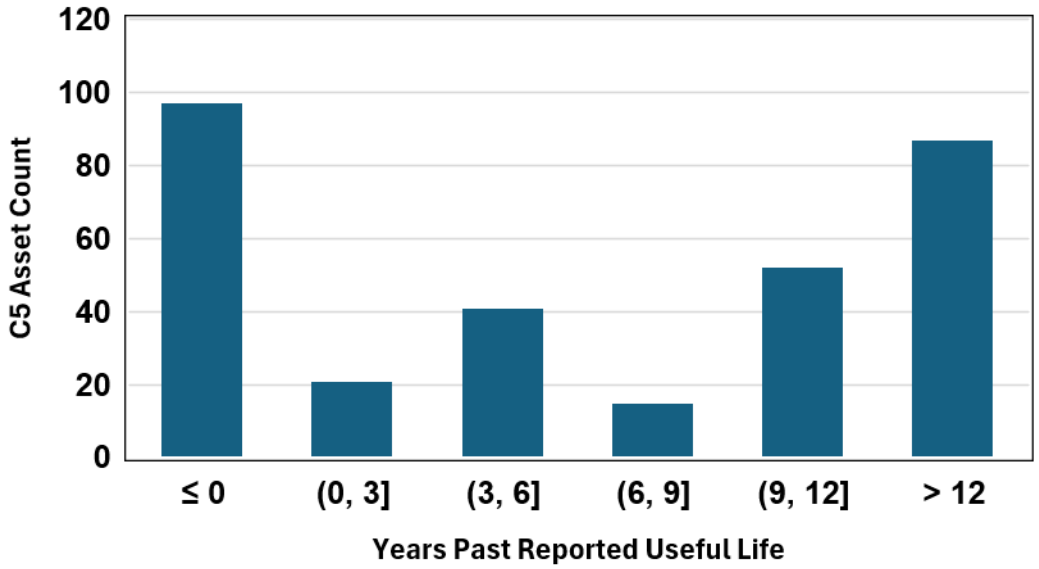


Figure 5. Histogram summarizing years past reported useful life for C5 assets with reported useful lifetimes.

4.2.2 Equipment and System Analysis

4.2.2.1 Methodology

Exponent reviewed available Daily Equipment Status Reports for the JIWRF (2016-2026) and SSWRF (2024-2026). These reports are created by plant staff once or twice daily to exchange information from one shift to another, including the operational status of treatment equipment, utility systems, biosolids equipment, and other plant infrastructure. The records were provided in the form of spreadsheets and generally identified equipment that was reported by staff as available, in service, out of service, under maintenance, or otherwise unavailable during a given reporting period. These spreadsheets are manually updated internal Veolia documents that reflect a moment in time at the plant and can become stale as operations and flows are often dynamic throughout a single shift. Veolia provided approximately 5,900 spreadsheets during the evaluation period. Exponent developed a targeted code using Python to extract data entries from these spreadsheets to create a unified database.

The data was used to evaluate both individual equipment asset availability as reported by Veolia staff, and whether the parent system asset may have had reduced capacity given the availability of its sub-systems/equipment assets. Using this combined equipment capacity and availability analysis, Exponent selected equipment that may have reduced JIWRF's and SSWRF's overall capacities and evaluated these selected equipment assets to understand their overall maintenance

history and reasons for reported lower availability (see list below). We considered WO history, PM, PdM, CM, and whether the equipment was involved in a capital project.

Selected Equipment for SSWRF (2024-2026)

- Flow Control Valve: Battery 3
- Grit channel 5
- Primary Clarifier 2
- RAS Pump 2-1 (east plant)
- Hypochlorite Pump 5
- Final Effluent Pumps 1

Selected Equipment for JIWRF (2018-2026)

- HL Screw Pump 4
- Bar Screen 3
- Grit Basin 4
- Primary Clarifier 2
- Secondary Clarifiers 2

4.2.2.2 Findings on Veolia's PM Strategy

In accordance with the Veolia Agreement, Veolia prepared PM strategies for JIWRF and SSWRF equipment assets through SMPs for MMSD approval, which contained references to original equipment manufacturers' (OEMs') recommendations and prior Operators' PM strategies. According to Veolia, the provided SMPs have been approved by MMSD, but the approval was not recorded within the documents provided to us and, as such, could not be verified by Exponent. These PM strategies are then put into practice in VAMS (previously OWAM), of which Exponent has reviewed an export of the current PM schedules. Exponent compared Veolia's current PM strategy from VAMS[30] with the provided SMPs and OEM recommendations (via O&M manual transmittals) for the assets identified as having relatively low availability in the period 2016-2026.

Veolia's current PM strategy does not always match the OEMs' recommendations and the SMPs for equipment. In some cases, Veolia's PM activities are more frequent, while in other cases less frequent, than the OEM recommendations. Some instances of OEM-recommended PM activities were not represented in the SMPs. Exponent is not aware of an SOP that defines how the PM strategy is developed or how maintenance deviations from OEM recommendations are proposed and assessed. Deviations from OEM recommendations can occur for many reasons, such as

[30] PM Strategy Report for the C5 Assets, All PM Route Details.

operating experience, management of limited resources, or that some PM activities are not listed in provided PM strategies because they are covered during walk-throughs. Exponent does not have enough information to assess the reasons for the deviations at this time, but specific deviations are noted below.

4.2.2.3 Targeted Review of Low-Availability Asset PM Strategies

Exponent performed a targeted review of PM Strategies for the selected low-availability SSWRF equipment (i.e., Flow Control Valve: Battery 3, Grit Channel 5, Primary Clarifier 2, RAS Pump 2-1 [east plant], Hypochlorite Pump 5, Final Effluent Pumps 1) and JIWRF equipment (i.e., HL Screw Pump 4, Bar Screen 3, Grit Basin 4, Primary Clarifier 2, Secondary Clarifiers 2). Below are four examples of the analyses to evaluate whether Veolia met the Standards of Maintenance and Prudent Industry Practices (MMSD and Veolia 2007) and, if not, whether Veolia's PM strategy may have caused or contributed to low equipment availability.

SSWRF: Flow Control Valve: Battery 3

The Flow Control Valve (asset number: E-00017481) is a butterfly valve for controlling flow to Battery 3, which is comprised of Primary Clarifiers 9-12. Exponent has not been provided an OEM manual or SMP for this C5 asset. The Flow Control Valve for Battery 3 has an annual PM that includes greasing the output drive, checking packing for leaks, and stroking the valve in both directions.[31] Despite having the lowest availability of the four SSWRF Flow Control Valves, this asset was unavailable because other equipment needed repairs, not due to failure of the asset itself.[32] Therefore, there is no evidence that Veolia's maintenance approach to the Flow Control Valve for Battery 3 caused it to be unavailable.

SSWRF: RAS Pump 2-1 (East Plant)

There are 10 Return Activated Sludge (RAS) pumps for SSWRF, with 5 in the west plant and 5 in the east plant.[33] They are used to pump return activated sludge from the secondary clarifiers back to the aeration tanks (Veolia No date-a). Of the 10 RAS pumps, RAS Pump 2-1 (east plant) had the lowest availability and is assigned as a C3 equipment asset.

According to the records, RAS Pump 2-1 (east plant) was out of service between January 3, 2024, and July 2025 due to a "bad" impeller. The impeller was replaced late in July 2025, and the pump has been operational since.[34] The records we have reviewed do not explain how or why the impeller failed. Therefore, we cannot determine the cause of failure, and we have seen no

[31] All PM Schedules Details.
[32] SSWRF Daily Equipment Status Reports.
[33] SSWRF Daily Equipment Status Reports (e.g., Daily Equipment Status Report 9-23-24).
[34] SSWRF Daily Equipment Status Reports.

evidence that Veolia's maintenance approach to RAS Pump 2-1 caused it to be unavailable. Exponent reviewed Veolia's SMP for RAS Pump 2-1 (east plant) and found that Veolia met most OEM-recommended maintenance frequencies (Veolia No date-a).[35]

Table 9. Summary of RAS Pump 2-1 (east plant), Pump (E-00018256) maintenance.

Task	OEM Frequency	SMP Frequency	Veolia PM Frequency	Veolia meets OEM rec.?
Check bearing temperature	Monthly	--	Monthly	Y
Check bearing lubricant for saponification	Quarterly	Monthly	Monthly	Y
Lubricate grease seals	--	Monthly	Monthly	--
Check alignment	Semi-annually	Annually	Annually	N
Grease pump bearings	--	Quarterly	Annually	--
Check bolts for tightness	--	Annually	Semi-annually	--
Check impeller wear ring clearance	Annually	Continuous Through OPS[36]	Annually	Y
Check discharge pressure	Annually	On Daily Ops Checklist	Daily	Y
Check coupling wear	Annually	Annually	Annually	Y
Vibration analysis	--	--	Quarterly	--
IR Thermography	--	Annually	Bearings monthly	--

Table 10. Summary of RAS Pump 2-1 (east plant), Motor (E-00018257) maintenance

Task	OEM Frequency	SMP Frequency	Veolia PM Frequency	Veolia meets OEM rec.?
Grease motor bearings	Annually	Quarterly	Annually	Y

JIWRF: Primary Clarifier 2

Primary Clarifier 2 (Asset Number: E-00010362) is a primary clarifier designed to remove grease, floatables, and quick-settling solids from the process wastewater stream to protect downstream equipment, prevent solids from collecting in downstream tanks, and reduce the solids and BOD loading on the secondary process (Veolia No date-b). Exponent has not been provided an SMP for this C5 asset. OEM manuals were provided for the Primary Clarifier Drive

[35] RAS pump log
[36] OPS refers to daily operations of the plant, including operator rounds and data monitoring.

Units[37] and Pier Extensions & Drive Platforms,[38] which contain recommended PM for specific components of Primary Clarifier 2, but we did not receive OEM manuals for the components that experienced maintenance issues – the rake arms, motion sensor, and drain valve. Primary Clarifier 2 has a biennial PM that includes complete washdown of launders, basin hopper, and feed box, and inspection of walls and basin floor to look for large cracks, heaving of basin floor, hollow areas on basin floor, and spalling of walls, launder, and basin floors.[39]

Apart from brief outages, Primary Clarifier 2 was out of service between October and December 2019 for a capital project, in January 2020 due to a low motion sensor issue, in September 2021 for cleaning, briefly in February 2022 for rake arm issues, between April and June 2023 for drain valve replacement, briefly again in June 2024 for rake arm issues, between the end of May and mid-June 2025 for PM, and mid-February through mid-March 2026 for CM.[40] Currently, Exponent does not have enough information (we have not received the SMP and complete set of OEM manuals) to determine whether Veolia's maintenance strategy caused the JIWRF Primary Clarifier 2 to be unavailable.

JIWRF: Secondary Clarifier 2

There are 33 total Secondary Clarifiers at JIWRF, including 10 in the East Plant, 12 in the New East Plant, and 11 in the West Plant. To achieve full capacity, certain combinations of availability must be met; for example, a maximum of one clarifier from each plant, two East Plant clarifiers, or four total clarifiers from the New East Plant and West Plant may be out of service and still allow JIWRF to maintain full capacity.[41] The secondary clarifiers are used to remove suspended solids from the mixed liquor and allow clear water to overflow to the disinfection process and underflow sludge to be returned to the aeration tanks or wasted from the system (Veolia 2011a,b). Of the 33 Secondary Clarifiers, Secondary Clarifier East Plant #2 had the lowest availability and is assigned as a C3 asset.

According to the records, Secondary Clarifier East Plant #2 did not experience any outages in 2018 and experienced a brief outage between May 23 and June 10, 2019.[42] In 2020, no specific issues with Secondary Clarifier East Plant #2 were noted. In 2021, Secondary Clarifier East Plant #2 was taken out of service for PM between September 16 and November 17, 2021, and no issues were noted in 2022. At the end of 2023, Secondary Clarifier East Plant #2 was taken out of service for PM and was still out of service at the end of 2024. In December 2024, issues with

[37] O&M 2112 - Primary Clarifier Drive Units - 206-M-4-1-1 to 8 - J01028
[38] O&M 2112 - Primary Clarifier Pier Extensions & Drive Platforms - J01028
[39] All PM Route Details.
[40] JIWRF Daily Equipment Status Reports.
[41] JIWRF Daily Equipment Status Reports (e.g., 1-3-24 Daily Equipment Status Report-0600 PM).
[42] JIWRF Daily Equipment Status Reports.

the RAS line were identified and noted through September 2025. A RAS channel outage has been in progress since May 2026.

Exponent compared Veolia's current PM strategy with the OEM recommendations and the provided SMP for Secondary Clarifier East Plant #2. For all subcomponents, the SMP required a lower frequency of PM than recommended by the OEM. As a result, the current PM strategy did not meet OEM recommendations. In some instances, the current PM strategy also did not meet the SMP recommendations. Currently, Exponent does not have enough information to determine whether Veolia's maintenance strategy caused the Secondary Clarifier East Plant #2 to be unavailable.

Table 11. Summary of Secondary Clarifier East Plant #2 (E-00010918) maintenance.

Task	OEM Frequency	SMP Frequency	Veolia PM Frequency	Veolia meets OEM rec.?
Gear Reducer				
Check gearbox oil levels	Weekly	Monthly	Weekly	Y
Grease lineshaft bearings	Monthly	Monthly	Monthly	Y
Change oil in center gearbox and two end units	Semi-Annually	Annually	Not scheduled	N
Oil analysis	Semi-Annually	Annually	Not scheduled	N
Surface Skimmer, Scum Baffle, Weirs, Scum Beach				
Grease all fittings of "pivoted" type skimmer	Monthly	Monthly	Not scheduled	N
Inspect skimmer assembly	Semi-Annually	Annually	Not scheduled	N
Inspect components for damage/loose parts, missing parts or damaged rubber seals	Semi-Annually	Annually	Not scheduled	N
Check and reestablish elevations, if needed	Semi-Annually	Annually	Not scheduled	N
Tow-Bro Unitube Header				
Inspect orifices; clean out any blockages	Semi-Annually	Biennial	Not scheduled	N
Check condition of fluidizing blades	Semi-Annually	Biennial	Not scheduled	N
Check for consistent clearance between header and floor	Semi-Annually	Biennial	Not scheduled	N
Tow-Bro Manifold Seals				
Inspect manifold seals; replace if cracked or tattered	Semi-Annually	Biennial	Not scheduled	N
General				
Inspect and replace sacrificial anodes as needed; log this activity	--	Biennial	Not scheduled	--
Check structure for corrosion	--	Biennial	Not scheduled	--
Inspect bridge expansion points and support pads; ensure pads and bolt slots are free of debris and bridge can move freely	Monthly	Biennial	Quarterly	N
Inspect all related valves for proper operation	--	Biennial	Not scheduled	--

4.3 Capacity Analysis

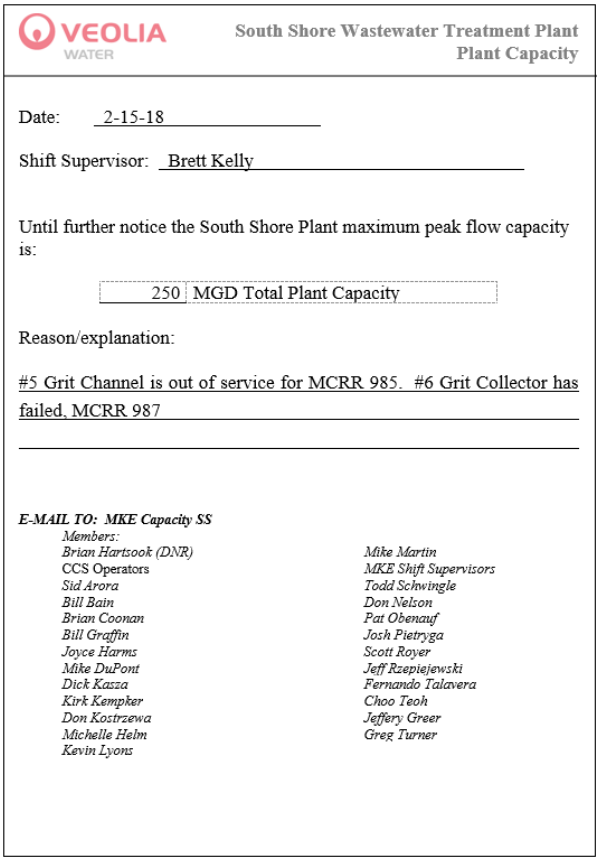
Veolia is required by the Agreement to report intentional reductions in plant capacity to MMSD. We assessed whether Veolia's reported reductions agreed with their internal documentation of equipment availability to assess whether Veolia complied with their capacity reduction reporting requirement. Although we did not find perfect agreement between these two data sources, we did not identify any systemic inaccuracies in Veolia's capacity reporting.

Veolia issues periodic reports to MMSD summarizing the available peak flow capacity of JIWRF and SSWRF, which are referred to as "Capacity Faxes."[43,44] These reports identify the equipment or systems reported by Veolia that limit capacity below the design treatment capacity for the two facilities (MMSD and Veolia 2007, 2016).

- JIWRF Design Capacity – 390 MGD (peak with diversion) / 330 MGD (peak without diversion)
- SSWRF Design Capacity – 300 MGD

Exponent received a total of 1,692 capacity reports supplied in Word/PDF format. Exponent evaluated the capacity reported to MMSD for the JIWRF and SSWRF treatment plants in the evaluation timeframe (2016 to 2026) using a subset of 1,069 capacity reports. An example Capacity Fax document for the SSWRF treatment plant dated February 15, 2018, is shown in Figure 6.[45]

[43] JIWRF Capacity Faxes.
[44] SSWRF Capacity Faxes.
[45] SSWRF Capacity Fax, dated February 15, 2018.



VEOLIA WATER

South Shore Wastewater Treatment Plant
Plant Capacity

Date: 2-15-18

Shift Supervisor: Brett Kelly

Until further notice the South Shore Plant maximum peak flow capacity is:

250 MGD Total Plant Capacity

Reason/explanation:

#5 Grit Channel is out of service for MCRR 985. #6 Grit Collector has failed, MCRR 987

E-MAIL TO: MKE Capacity SS

Members:

Brian Hartsook (DNR)
CCS Operators
Sid Arora
Bill Bain
Brian Coonan
Bill Graffin
Joyce Harms
Mike DuPont
Dick Kasza
Kirk Kempker
Don Kostrzewa
Michelle Helm
Kevin Lyons
Mike Martin
MKE Shift Supervisors
Todd Schwingle
Don Nelson
Pat Obenauf
Josh Pietryga
Scott Royer
Jeff Rzepiejewski
Fernando Talavera
Choo Teoh
Jeffery Greer
Greg Turner

Figure 6. Example Capacity Fax report for the SSWRF dated February 15, 2018, reports a total peak flow plant capacity of 250 million gallons per day.[46] Notes for any outages or lowered capacities are provided in the "Reason/explanation" field.

Exponent extracted the total plant capacity data from the provided reports for the JIWRF and SSWRF plants using a targeted code written in the MATLAB language to create a unified database. Note that no Capacity Fax reports were provided for SSWRF from January 1, 2016, to February 21, 2017. Per Exponent's understanding from Veolia, when no Capacity Fax is transmitted, the capacity remains unchanged from the capacity reported in the previous Capacity Fax. Exponent has incorporated this understanding into Figure 7 and Figure 8, which plot the capacity data for the SSWRF and JIWRF plants. It should be noted that the JIWRF capacity (purple) is reported *with* diversion capability in place (i.e., 390 MGD). This is achieved by diverting up to 60 MGD of flow to chlorination in-plant bringing the maximum to 390 MGD when added to the maximum rated capacity of 330 MGD.[47] This is shown as the upper limit for

[46] SSWRF Capacity Fax, dated February 15, 2018.
[47] Note that JIWRF is capable of diverting 100 MGD in-plant, but is only permitted for 60 MGD.

the JIWRF plant. The SSWRF plant does not possess the capability to divert flow; 300 MGD is the maximum possible capacity for that plant as a result.

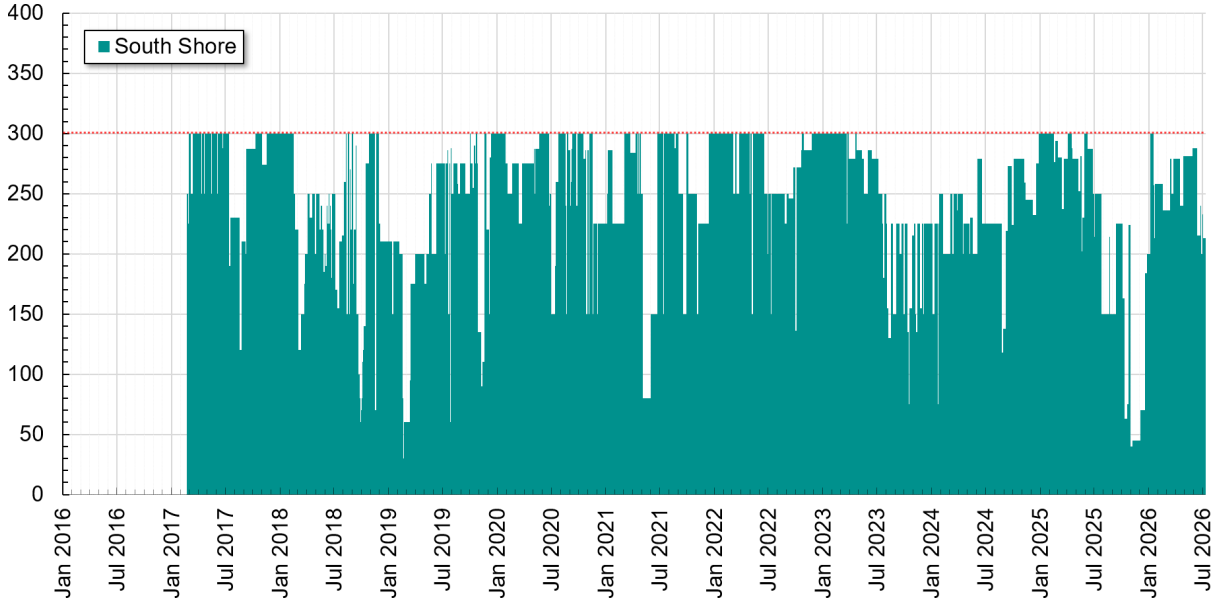


Figure 7. Reported total treatment capacity data for the SSWRF plant from February 22, 2017 (January 1, 2016, to February 21, 2017 were not available for review) to 2026, as derived from the provided Capacity Faxes.[48] Per Exponent's understanding from Veolia, on days where no Capacity Fax was transmitted, the plant capacity is unchanged from that of the most recent Capacity Fax. The dashed red line represents the maximum capacity (300 MGD) of the SSWRF plant.

[48] SSWRF Capacity Faxes.

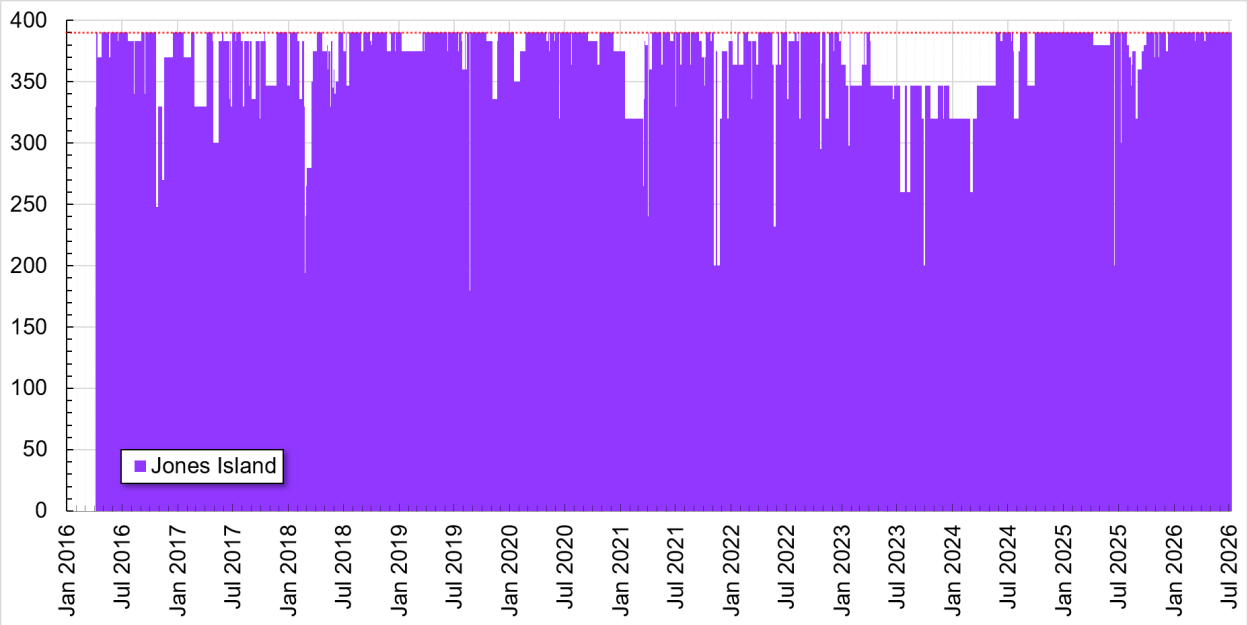


Figure 8. Reported total treatment capacity data for the JIWRF plant from 2016 to 2026, as derived from the provided Capacity Faxes.[49] Per Exponent's understanding from Veolia, on days where no Capacity Fax was transmitted, the plant capacity is unchanged from that of the most recent Capacity Fax. The dashed red line represents the maximum capacity (390 MGD, with in-plant diversions) of the JIWRF plant.

Additionally, Exponent reviewed 6,600 Daily Equipment Status Reports in the form of Excel documents for JIWRF (6,063 reports) and SSWRF (537 reports).[50,51] These reports are created once or twice daily by plant staff to exchange information from one shift to another and include a snapshot of the equipment status for each piece of equipment at the JIWRF and SSWRF plants. These spreadsheets are manually updated internal Veolia documents which reflect a moment in time and therefore may not necessarily reflect equipment and plant status for an entire shift. The maximum available capacity for the JIWRF plant as reported in these Daily Equipment Status Reports was 330 MGD, which does not include the in-plant diversion capacity of 60 MGD. As an example, an excerpt of the Daily Equipment Status report for JIWRF from October 2, 2018, at 09:00 is shown in Figure 9.

[49] JIWRF Capacity Faxes.
[50] JIWRF Daily Equipment Status Reports.
[51] SSWRF Daily Equipment Status Reports.

	10/2/18	9:00 AM				
Treatment Capacity		280 MGD	Reason	Secondary blanket levels are elevated		
	LL Screw Pumps	4	188			
	Equipment	I/S	Available	O/S	Capacity	Comments
	LL Screw Pump # 1	X			47 MGD	
	LL Screw Pump # 2		X		47 MGD	
	LL Screw Pump # 3		X		47 MGD	
	LL Screw Pump # 4	X			47 MGD	
	****Only need 3 LL Screw Pumps available for full capacity.					
	HL Screw Pumps	4	330			
	Equipment	I/S	Available	O/S	Capacity	Comments
	HL Screw Pump # 1	X			82 MGD	
	HL Screw Pumps	X			82 MGD	
	HL Screw Pumps		X		82 MGD	
	HL Screw Pumps	X			82 MGD	
	HL Screw Pumps			X	82 MGD	
	****Only need 4 HL Screw Pumps available for full capacity.					
	Bar Screens	7	385			
	Equipment	I/S	Available	O/S	Capacity	Comments
	Bar Screen # 1	X			55 MGD	
	Bar Screen # 2	X			55 MGD	
	Bar Screen # 3	X			55 MGD	
	Bar Screen # 4	X			55 MGD	
	Bar Screen # 5	X			55 MGD	
	Bar Screen # 6	X			55 MGD	
	Bar Screen # 7			X	55 MGD	
	Bar Screen # 8	X			55 MGD	
	****Only need 6 Bar Screens available for full capacity					

Figure 9. Example Daily Equipment Status Report for JIWRF from October 2, 2018, at 09:00, reporting a total peak flow plant capacity of 280 MGD. The report lists equipment-level design capacities and operating conditions for screw pumps, bar screens, grit basins, clarifiers, aeration, storage basins, chlorine feed channels, contact basins, and biosolids processing equipment. Note that for clarity, only capacities and operating conditions for screw pumps and bar screens are shown in this figure.[52]

From these Daily Equipment Status Reports, Exponent extracted the percentage of total equipment online on a given day and compared this equipment availability to the plant flow capacities reported in the Capacity Faxes to determine if there was "Agreement" or "Disagreement" between the reported capacity and the equipment availability. The purpose of this analysis is to assess the accuracy of Veolia's reported capacities in the Capacity Faxes. "Agreement" represents three scenarios:[53]

[52] JIWRF Daily Equipment Status Report, dated October 2, 2018.

[53] Veolia reports the quantity of equipment in each system required to achieve full capacity in the Daily Equipment Capacity Reports. For example, only 6 of 8 bar screens must be available at JIWRF to achieve design capacity. If

1. The reported total flow in the Capacity Fax is the maximum capacity for the plant (i.e., 300 MGD for South Shore and 330 MGD for Jones Island) and 100% of the equipment needed to achieve that full capacity is reported online in the Daily Equipment Status Report.
2. The reported total flow in the Capacity Fax is less than maximum capacity, and less than 100% of the necessary equipment is reported online in the Daily Equipment Status Report.
3. The reported total flow in the Capacity Fax is less than maximum capacity, and 100% of the equipment needed to achieve that full capacity is reported online in the Daily Equipment Status Report.

"Disagreement," however, represents the scenario where the Capacity Fax reports a maximum treatment capacity, but not enough equipment is reported online and available in the Daily Equipment Status Report to achieve maximum flow. Table 12 is a matrix illustrating these scenarios.

Table 12. Agreement/Disagreement definition matrix used to evaluate reported capacity compared with equipment availability.

	Capacity Fax Treatment Reported at 100%	**Capacity Fax Treatment Reported < 100%**
Daily Equipment Status Report Availability at 100%	Agreement	Agreement
Daily Equipment Status Report Availability < 100%	Disagreement	Agreement

Figure 10 and Figure 11 apply this decision matrix to the capacity as reported to MMSD in the Capacity Faxes[54] and equipment availability as reported in the Daily Equipment Status Reports for SSWRF and JIWRF, respectively, across the dates where these data sets overlap. Instances of agreement between capacity and equipment availability are displayed in teal (SS) and purple (JI). Instances of disagreement are displayed as red dots.

at least 6 bar screens are available, this subsystem is considered fully available. If fewer than 6 bar screens are available, this system is considered less than fully available. If all subsystems are fully available, then we consider 100% of the required equipment to be available. Note this is different than having 100% of all equipment available, as the plant has redundant equipment to account for temporary unavailability of individual equipment.

[54] Capacity as reported on MMSD website, which was provided to Exponent along with the SCADA data.

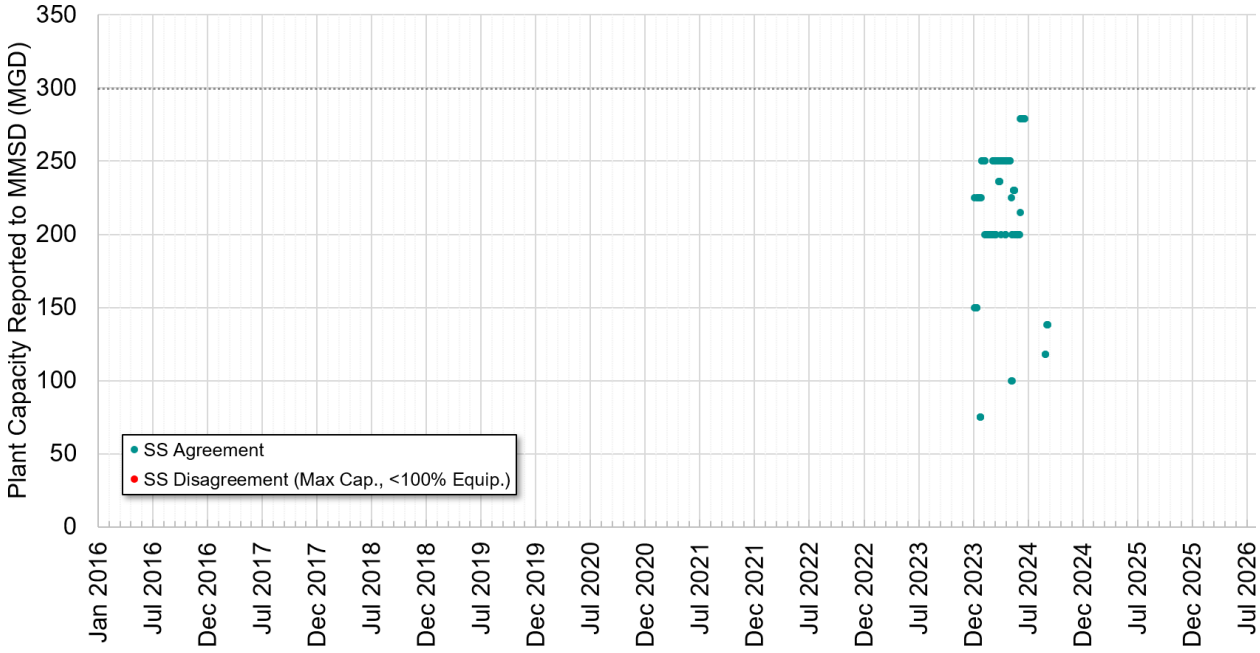


Figure 10. Comparison of plant capacity reported on the MMSD website and percentage of plant equipment availability for SSWRF based on the available Daily Equipment Status Reports.[55] No data points of "Disagreement" (red dots) were observed, which would indicate instances where maximum treatment capacity is reported despite insufficient equipment availability. The dashed black line indicates the maximum treatment capacity of 300 MGD. Note that Exponent's data for the capacity reported to MMSD and percentage of plant equipment availability only overlapped in the calendar year 2024.

[55] SSWRF Daily Equipment Status Reports, MMSD dashboard.

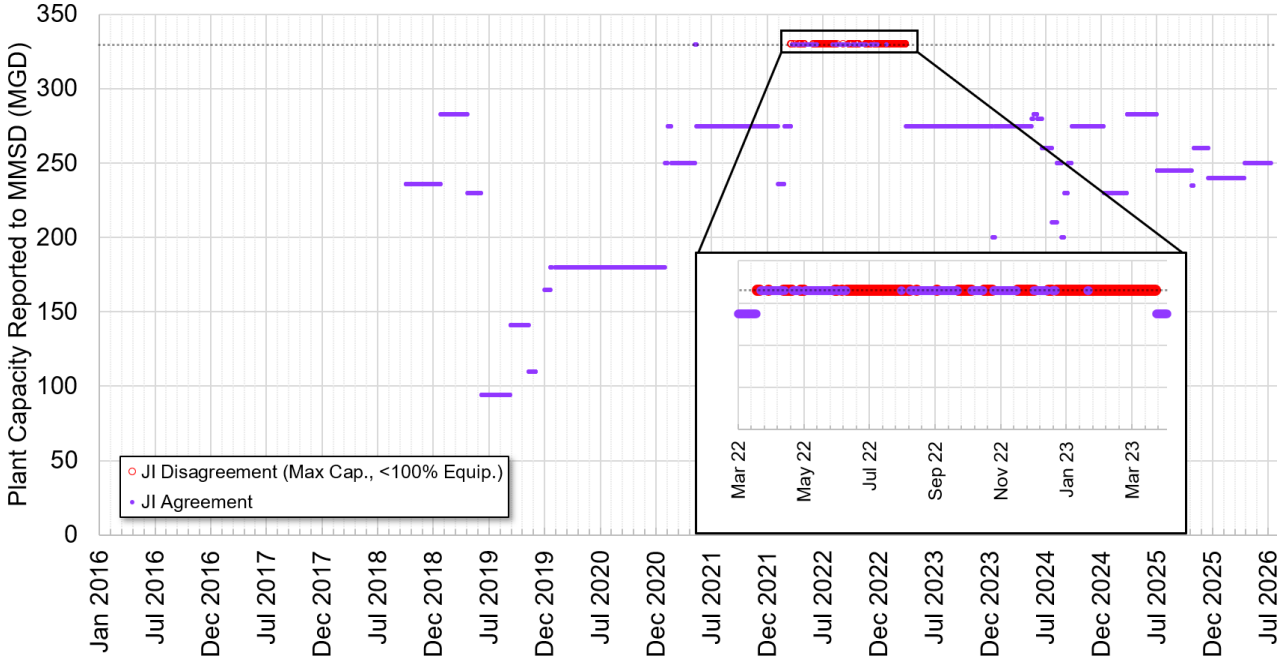


Figure 11. Comparison of plant capacity reported on the MMSD website and percentage of plant equipment availability for JIWRF based on the available Daily Equipment Status Reports.[56] "Disagreement" (red dots) indicates instances where maximum treatment capacity was reported despite insufficient equipment availability. The dashed black line indicates the maximum treatment capacity (without in-plant diversions) of 330 MGD. The inset plot is enlarged to show the red instances of disagreement between April 2022 and April 2023.

From this comparison, in the 2016-2026 timeframe, only a subset of the reported capacities for JIWRF dated between April 2022 and April 2023 show disagreement between total flow capacity reported on the MMSD website and the percent of equipment availability as recorded in the Daily Equipment Status Reports, and SSWRF experienced no instances of disagreement using the limited data available for this analysis. As noted above, the equipment availability in the Daily Equipment Status Reports is manually recorded and can contain errors, which may explain the instances of disagreement. It is also our understanding that State Point Analysis can result in discrepancies between equipment availability and plant capacity.[57] Regardless of the reason for any discrepancies, we have found only one period during which disagreements occurred between capacity reported to MMSD and Veolia's internal documentation of equipment availability. Therefore, we did not find any systemic inaccuracies in Veolia's capacity reporting.

[56] JIWRF Daily Equipment Status Reports, MMSD dashboard.

[57] It is our understanding that adjustments to plant operations and treatment capacity can be made based on effluent monitoring.

4.3.1 Wet Weather Analysis

We assessed Veolia's compliance with two requirements of the Agreement that apply during wet weather events:

1. To operate at design capacity unless restricted by Veolia's maintenance or Capital Repair/Replacement obligations;
2. To maximize the volume of wastewater captured, stored, conveyed and treated.

Veolia is required by the Agreement to comply with the Wet Weather Protocol (Extension 7) of the Agreement (MMSD and Veolia 2016). The Wet Weather Protocol requires Veolia to maximize system capacity during wet weather events (MMSD and Veolia 2016):

> *During Wet Weather Conditions, [Veolia] shall operate the System to maximize the volume of wastewater captured, stored, conveyed and treated in order to prevent sewerage overflows.*

The Wet Weather Protocol also requires Veolia to create a Wet Weather Standard Operating Procedure (WWSOP) with specific guidelines and goals for wet weather events (MMSD and Veolia 2016):

> *This Extension Schedule 7 outlines the minimum requirements for the Company's response to Wet Weather Conditions. It is the intention of this protocol to set guidelines and goals for the operation of the System during Wet Weather Conditions. As such, the Company shall prepare detailed Standard Operating Procedures ("SOPs"), consistent with this Extension Schedule 7, for operation of the Jones Island and South Shore WRFs as well as the Collection and Conveyance System during Wet Weather Conditions.*

Per the Agreement, Veolia is required to comply with the requirements of all SOPs drafted during the Initial Term, as well as any modifications made during the Extension Term (MMSD and Veolia 2016):

> *During the Initial Term, the Company prepared a set of standard operating procedure ("SOP") documents addressing all elements of System operations and the procedures to be followed. The Company shall comply with the requirements of such SOPs and any modifications made to the SOPs during the Extension Term. The Company is solely responsible for the development, updating and timely implementation of all SOPs necessary to fully comply with its obligations under this Extension Agreement.*

Exponent reviewed the WWSOP for the JIWRF, which aims to maximize the storage capacity of the ISS in order to maximize the volume of wastewater that is captured, stored and conveyed (Veolia 2001).

> *The normal strategy is to maximize the capacity of the tunnel storage for wet weather events… During wet weather the tunnel pumps will be operated to maximize the protection of area water quality and public welfare. This requires assessment of both the storm potential and the treatment capability. Pumping too much water to the plants can degrade overall water quality or damage critical facilities. Pumping too little water to the plants can reduce the collection of storm water… During severe storms the goal is to reach the stated plant capacity and maximize tunnel capacity.*

In addition, the WWSOP aims to maximize the volume of wastewater that receives full treatment, limiting the volume that is bypassed or diverted. Prior to storm events, JIWRF staff are to assess critical equipment using the checklists for primary and secondary processes for high flow and make critical equipment available to the "maximum extent possible" (Veolia 2001).

Veolia's WWSOP for JIWRF identifies equipment availability as a determining factor in the plant's treatment capacity. Equipment failures, planned outages, and the number of process units available for service can reduce the hydraulic capacity of the plant. The WWSOP provides the number of necessary units that can be out of service without reducing the plant's full treatment capacity. However, there are no requirements in the Agreement to achieve full treatment capacity or have a minimum quantity of equipment available and in service during wet weather events. Per Part 2, Flow Diversion and Flow Limitations, of the JIWRF WWSOP (Veolia 2001):

> *The number of critical process units available for service determines the plant peak hydraulic capacity…Having more or less units in service [a]ffects the hydraulic capacity of the plant and the shift supervisor needs to consider this during wet weather operations.*

Using the WWSOP and the Daily Equipment Status Reports provided for JIWRF, Exponent compared the availability of wet-end equipment at JIWRF during wet weather CSO events to the equipment required to meet full treatment capacity.

4.3.1.1 Selected Wet Weather CSO Events

To determine the periods during which CSOs were reported, Exponent reviewed CSO Event Reports submitted by MMSD to the WDNR. Wet weather CSO events were reviewed beginning with the most recent event in April 2026, working backward. Events were selected only when the corresponding CSO reports submitted by MMSD to WDNR were publicly available. These reports were used to identify the timing and duration of CSOs, summarized in Table 13, below.

Table 13. Selected Wet Weather Events Resulting in Combined Sewer Overflows

Rainfall Event	Estimated CSO Timeframe	Estimated CSO Duration (hours)	Estimated CSO Volume (MG)
April 2026	8:24 p.m., April 14 – 2:00 p.m., April 19	114	2,700
August 2025	10:00 p.m., August 9 – 3:55 a.m., August 13	78	5,010
April 2024	5:55 p.m., April 2 – 8:10 p.m., April 4	50	357
February-March 2023	11:30 a.m., February 27 – 8:00 a.m., March 1	45	230
August 2021	2:00 a.m., August 8 – 11:00 p.m., August 10	69	380

Sources: MMSD 2021b, 2024a,b, 2025, 2026a

Notes: MG -- million gallons

4.3.1.2 Evaluation of Equipment Availability During Wet Weather Events

Utilizing the equipment service requirements to meet full capacity, as described in the WWSOP and the CSO event durations provided in Table 13, Exponent reviewed Daily Equipment Status reports issued during each wet weather event to evaluate whether critical process units met the full-capacity criteria. As noted previously, Daily Equipment Status reports are manually updated by facility operators. The results of this analysis are summarized in Table 14 below.

Table 14. JIWRF Equipment Status During Reported Combined Sewer Overflows

CSO Event Date	Out of Service Equipment Limiting Full Capacity Operations
April 2026	Secondary clarifiers (East #1, 2; New East #16, 20)
August 2025	High-level screw pumps (#4, 5), Bar screens (#2, 3, 6), Secondary clarifiers (East #2, 6, 10; New East #12, 15, 17; West #10)
April 2024	High-level screw pumps (#1, 4), Secondary clarifiers (East #2, 3, 10; New East #14, 15, 22)
February-March 2023	High-level screw pumps (#1, 5), Grit basins (#3, 4)
August 2021	Secondary clarifiers (East #3; New East #11, 22; West #1)

Collectively, the data in Table 14 reveal that for each of the evaluated CSO events, at least one category of equipment exceeded the allowable out-of-service numbers that can occur without reducing the plant's full treatment capacity. The equipment categories that most frequently limited full treatment capacity were the secondary clarifiers (with at least four outages during 4 of the 5 CSO events) and high-level screw pumps (with at least two outages during 3 of the 5

events). Among the secondary clarifiers, East Plant Clarifier #2 was out-of-service during 3 of the 5 events spanning 2024-2026, and East Plant Clarifier #10 and New East Plant Clarifier #15 were out-of-service during 2 of the 5 events spanning 2024-2025. High-level screw pumps #1, 4, and 5 were each down for 2 of the 5 events.

The reason for each secondary clarifier and high-level screw pump outage, as recorded in the Daily Equipment Status reports, is provided in Table 15, below.

Table 15. Reasons for Secondary Clarifier and High-Level Screw Pump Outages During Selected CSO Events

Equipment	CSO Event Date(s)	Reported Out of Service Reason
East Plant Secondary Clarifier #2	April 2024; August 2025; April 2026	Out of service during the 2024, 2025 and 2026 events with comments: "LOTO (PM)," "#2 RAS Line," and "MMSD," respectively
East Plant Secondary Clarifier #10	April 2024	"Rake arm HI torque"
	August 2025	"LOTO"*
New East Plant Secondary Clarifier #15	April 2024	"Gear Box Seal Inspection"
	August 2025	"Rake arm"
High-level Screw Pump #1	February-March 2023; April 2024	"LOTO – MMSD (Gearbox Issue)"
High-level Screw Pump #4	April 2024	"MCC malfunction"
	August 2025	"Electrical issue"
High-level Screw Pump #5	February-March 2023	"LOTO"*
	August 2025	"MCC-6 LOTO (MMSD)"

Sources: JIWRF Daily Equipment Status Reports, dated: 4:30 am, February 28, 2023; 6:00 am, April 3, 2024; 5:00 am, August 11, 2025; and 5:00 pm, April 14, 2026.

*Reason for LOTO (Lockout/Tagout) unspecified in Daily Equipment Status Report.

Based on the provided MCRR and WO histories and the Daily Equipment Status Reports for JIWRF, it appears the equipment outages in Table 15 resulted from a mix of PM, CM, and MCRR activities. However, Exponent was unable to determine the precise cause of each outage using the documentation provided.[58] Per the Agreement, Veolia is required to operate the plants at their design capacity unless restricted by their maintenance or Capital Repair/Replacement obligations (MMSD and Veolia 2016):

[58] Exponent reviewed the following MCRR and WO history lists: MCRR Project List, MCRR Work Order List VAMS, OWAM HIST 0804, OWAM WO History Crit 5 MCRR SWPPP (MCRR SA Work History) to determine the cause of equipment outages during CSO events.

> *the Company shall…at all times, exercise all reasonable efforts to implement measures to maximize the ability of the System to reduce effluent pollution discharges and shall not, at any time, intentionally reduce, including any reduction in its management, operation and maintenance expenses on the System, for any reason, other than for the performance of the Company's maintenance and Capital Repair or Replacement obligations that are otherwise applicable under this Extension Agreement, (1) the Design Capacity of the Treatment Plants…*

Thus, although the JIWRF operated at reduced capacity during four of the five CSO events assessed, the reported reasons for equipment outages during these events were PM, CM, and MCRR activities,[59] which are allowable causes for capacity reduction, per the Agreement. We therefore find Veolia to be in compliance with plant capacity requirements for the five CSO events we evaluated.

4.3.1.3 In-Plant Utilization During Wet Weather Events

Exponent evaluated whether Veolia met its requirement to maximize the volume of wastewater treated during the five CSO events reviewed. As part of this assessment, Exponent evaluated whether the JIWRF influent flow during each wet weather event met or exceeded the facility's reported full treatment capacity.

Under the Agreement, Veolia may reduce the plant's operating capacity when equipment is unavailable or out of service. However, during wet-weather events, Veolia is required to maximize the use of available treatment capacity to maximize the full treatment volume of influent flow and minimize untreated or partially treated effluent flow volume, as well as upstream CSO discharges.

Altogether, JIWRF reported that it could operate at 75% or more of its full treatment capacity, 330 MGD, for the five CSO events we evaluated, as provided in Table 16, below.

[59] Some equipment did not report a reason for outage other than lockout/tagout "LOTO." For this equipment, we cannot assess whether the cause for the outage was an allowable cause for a capacity reduction.

Table 16. JIWRF Capacity Utilization and Influent Flow Volumes During Reported Combined Sewer Overflows

CSO Event Date	Reported Full Treatment Capacity (MGD)[1]	% of Full Treatment Capacity (% of 330 MGD)	Daily Influent Flow (MGD)[2]
April 2026	310	94	271-379
August 2025	247-264	75-80	115-330
April 2024	247	75	259-338
February-March 2023	247	75	256-273
August 2021	330	100	219-300

1 – As reported in Capacity Fax data for JIWRF. Note: "full treatment" capacity is determined by the limiting value assigned to either primary or secondary treatment.
2 – As reported in the WIMS database. Note: reported influent flow is not equivalent to fully treated flow. Influent flow may receive partial or full treatment.

Despite equipment outages, daily influent flow volumes reported during four of these five events were generally equivalent to or greater than the full treatment capacity reported by JIWRF during each event. One exception is the August 2021 CSO event, in which influent flow volumes never exceeded 300 MGD and fell to 219 MGD over time, despite the facility reporting a full treatment capacity of 330 MGD. Although influent flow volume data alone do not indicate how flow was allocated within the facility's treatment and diversion pathways, Exponent's analysis indicates that influent flow volumes exceeded the plant's reported full treatment capacity in four of the five events, and Exponent concluded that the facility attempted to maximize throughput, per the WWSOP. Maximizing flow to the JIWRF is a stated goal of the WWSOP in order to maximize the storage capacity of the ISS and maximize the volume of wastewater that is captured, stored and conveyed. Exponent's analysis indicates the JIWRF achieved this goal during four of the five events analyzed.

5 Major Findings

Exponent evaluated Veolia's compliance with environmental requirements in the Veolia Agreement and the WPDES permit as detailed in Section 3. Exponent's major findings are:

1. Exponent confirmed that Veolia collected one or more samples at SSWRF and JIWRF on each of the 3,834 days of the evaluation period.
2. The SSWRF was in compliance with WPDES permit effluent limits at Outfall 001 for 99.97% of sample results in the evaluation period.
    - SSWRF demonstrated 100% compliance with effluent limitations for BOD_5, fecal coliform, total phosphorus, pH, and total ammonia as nitrogen.

    - SSWRF demonstrated compliance rates of 99.9% for TSS, 99.98% for total residual chlorine, and 97.7% for mercury.
3. The JIWRF was in compliance with WPDES permit effluent limits at Outfall 002 for 99.94% of sample results in the evaluation period.
    - JIWRF demonstrated 100% compliance with effluent limitations for BOD_5, fecal coliform, and pH.
    - JIWRF demonstrated compliance rates of 99.9% for TSS, 99.9% for total residual chlorine, 99.1% for total phosphorus, and 99.2% for mercury.
4. The SSWRF and JIWRF were in compliance with Veolia Agreement effluent performance standards at Outfalls 001 and 002, for 95.82% and 99.68% of sample results in the evaluation period, respectively.
    - SSWRF demonstrated 100% compliance with effluent standards for total phosphorus. SSWRF compliance rates with effluent performance standards were 89.7% for total BOD_5, 96.0% for TSS, 96.8% for total ammonia as nitrogen, and 96.0% for fecal coliform.
    - JIWRF demonstrated 100% compliance with effluent performance standards for BOD_5, total ammonia as nitrogen, and fecal coliform. JIWRF compliance rates with effluent performance standards were 99.2% for TSS and total phosphorus.
5. The WPDES permit CSO performance standard of six or fewer CSO events in each calendar year was met during the evaluation period.
6. Veolia maintained compliance with the Veolia Agreement effluent performance standards and the WPDES permit effluent limits even during wet weather events, as there is no apparent relationship between CSO overflow events and compliance exceedances.

Exponent's analysis of Maintenance and Operational Readiness concluded that plant capacity was frequently reduced due to unavailable equipment. Exponent did not identify systemic deficiencies in Veolia's maintenance program as a cause of the unavailability. Our conclusions include:

- MMSD's C5 assets are, on average, five years past their estimated useful lives. Thus, many of the C5 assets are beyond their estimated useful lives and are at an elevated risk of failure, regardless of maintenance activities.
- We analyzed several assets with low availability that caused a reduction in plant capacity. We did not identify systemic deficiencies in Veolia's maintenance program as a cause of the equipment unavailability.
- We evaluated the PM strategy for a limited sample of assets and found that Veolia's preventative maintenance schedule was based on, but did not consistently align with, Veolia's SMP and recommendations from the

manufacturer. Exponent has not seen SOP that define how Veolia creates the PM strategy or proposes and assesses maintenance deviations from manufacturer's recommendations.

- Exponent evaluated Veolia's compliance with two requirements applicable to wet-weather events: (1) operating at design capacity unless restricted by Veolia's maintenance or Capital Repair/Replacement obligations; and (2) maximizing the volume of wastewater treated. Exponent assessed five wet-weather events during the evaluation period (2016-2026). The JIWRF reported reduced capacity during four of the five wet-weather events assessed. Each of the capacity reductions was the result of equipment outages. The reported reasons for equipment outages during these events were PM, CM, or MCRR obligations, which are allowable reasons in the Agreement for capacity reductions. Therefore, Veolia met the contractual capacity requirements during the five wet-weather events analyzed. During four of the five events, JIWRF recorded influent flow rates greater than or equal to the plant's reported maximum capacity. Although influent flow data alone do not indicate how flow was allocated within the facility's treatment and diversion pathways, the influent flow data indicate that Veolia maximized wet weather flows to the JIWRF during four of the five assessed CSO events.
- Between 2016 and 2026, Veolia completed 93% of PMs for C5 assets within 45 days, which is below the 95% goal.
- Exponent's examination of zero-cost work orders (those without any assigned labor or material cost) found that the relatively small quantity of zero-cost work orders was unlikely to affect overall work order closure statistics and did not indicate widespread failure to complete required maintenance activities. Of 33,662 work orders assessed, 250 (0.74%) were zero-cost work orders that lacked explanation. Many zero-cost work orders resulted from duplicate work, MCRR projects, or contractor-completed work.
- Exponent compared reported SSWRF and JIWRF capacities with reported equipment availability and identified one period, April 2022-April 2023 at the JIWRF, where WRFs reported full capacity and simultaneously reported insufficient equipment availability to meet the full capacity. It is Exponent's understanding that inconsistencies in manual updating of Veolia's internal Daily Equipment Status Reports contributed to this discrepancy. Except for the limited period of discrepancies, we did not find any systemic inaccuracies in Veolia's capacity reporting based on their internal documentation of available equipment.

6 Limitations

This memorandum summarizes work performed to date and presents the findings resulting from that work. The findings presented herein are made to a reasonable degree of scientific and

engineering certainty and are based upon data, information, and documentation provided by Veolia. Exponent reserves the right to supplement this evaluation and to expand or modify its findings based on review of additional material as it becomes available.

7 References

GLUMRB. 2014. Recommended standards for wastewater facilities. Policies for the design, review, and approval of plans and specifications for wastewater collection and treatment facilities. Wastewater Committee of the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Manager. Health Research, Inc., Albany, NY. 175 pp.

MMSD. 2015. MMSD asset life cycle. SOP# AM – 004. Dated August 1, 2015. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 11 pp.

MMSD. 2016. MMSD condition assessment. SOP# AM – 006. Dated June 14, 2016. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 14 pp.

MMSD. 2018a. July 4, 2018 combined sewer overflow event five-day notification letter, dated July 9, 2018. WPDES Permit No. WI-0036820-03-1. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 5 pp.

MMSD. 2018b. August 20–21, 2018 combined sewer overflow event five-day notification letter, dated August 24, 2018. WPDES Permit No. WI-0036820-03-1. Available at: https://www.mmsd.com/application/files/9815/3513/5243/MMSD_5DayNotificationLetter_August_20-21_2018_CSO.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 5 pp.

MMSD. 2018c. August 27–29, 2018 combined sewer overflow event five-day notification letter, dated August 31, 2018. WPDES Permit No. WI-0036820-03-1. Available at: https://www.mmsd.com/application/files/1215/3573/8882/2018_DNR_CSO_5-Day_Notice_082718.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 5 pp.

MMSD. 2018d. September 5–6, 2018 combined sewer overflow event five-day notification letter, dated September 10, 2018. WPDES Permit No. WI-0036820-03-1. Available at: https://www.mmsd.com/application/files/7615/3660/5388/2018_DNR_CSO_5-Day_Notice_9518.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD. 2018e. October 1–4, 2018 combined sewer overflow event five-day notification letter, dated October 8, 2018. WPDES Permit No. WI-0036820-03-1. Available at: https://www.mmsd.com/application/files/7215/3903/0870/2018_DNR_CSO_5-Day_Notice_100118.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD. 2021a. Annual notice–2020 combined sewer overflow public notification, dated April 27, 2021. WPDES Permit No. WI-0036820-04-0. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 46 pp.

MMSD. 2021b. August 8–10, 2021 combined sewer overflow event five-day report, dated August 13, 2021. WPDES Permit No. WI-0036820-04-0. Available at: https://www.mmsd.com/application/files/4016/2887/3674/2021_DNR_CSO_5-Day_Notice_Event_8.21_Web.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 8 pp.

MMSD. 2024a. Annual notice – 2023 combined sewer overflow public notification, dated April 25, 2024. WPDES Permit No. WI-0036820-04-0. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 35 pp.

MMSD. 2024b. April 2–4, 2024 combined sewer overflow event report, dated April 8, 2024. WPDES Permit No. WI-0036820-04-0. Available at: https://www.mmsd.com/application/files/7517/1260/7903/April_2-4_2024_5-Day_Report.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 6 pp.

MMSD. 2025. August 9–13, 2025, storm event five-day report: Combined sewer overflow, sanitary sewer overflow, sewage treatment facility overflow, and south shore effluent limits violation, dated August 15, 2025. WPDES Permit No. WI-0036820-04-0. Available at: https://www.mmsd.com/application/files/7017/5554/7337/Aug_9-13_2025_5-Day_Letter_Reports_Final_Reduced_File_w_signature.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 47 pp.

MMSD. 2026a. April 14–19, 2026, post-storm report: Combined sewer overflow, sanitary sewer overflow, and sewage treatment facility overflow, dated April 24, 2026. WPDES Permit No. WI-0036820-04-0. Available at: https://www.mmsd.com/application/files/7917/7706/4451/FINAL_2026_DNR_CSO_SSO-TFO_Notice_4.24.26.pdf. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 30 pp.

MMSD. 2026b. Annual notice – 2023 combined sewer overflow public notification, dated April 30, 2026. WPDES Permit No. WI-0036820-04-0. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 77 pp.

MMSD and Veolia. 2007. Agreement for management, operations and maintenance services between Veolia Water Milwaukee, LLC and the Milwaukee Metropolitan Sewerage District. December 3, 2007. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 825 pp.

MMSD and Veolia. 2016. Extension agreement for management, operations and maintenance services between Veolia Water Milwaukee, LLC and Milwaukee Metropolitan Sewerage District. June 27, 2016. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 945 pp.

MMSD and Veolia. 2022. Amendment one to the extension agreement for management, operations and maintenance services, dated December 12, 2022. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 77 pp.

MMSD and Veolia. 2023. Personal communication (e-mail to Veolia Water Milwaukee, LLC, dated January 17, 2023, regarding the definition of capital expenditure). Milwaukee Metropolitan Sewerage District, Milwaukee, WI.

MMSD and Veolia. 2024a. Amendment two to the extension agreement for management, operations and maintenance services, dated February 15, 2024. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 2 pp.

MMSD and Veolia. 2024b. Settlement agreement and amendment three to the extension agreement for management, operations and maintenance services, dated March 25, 2024. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD and Veolia. 2024c. Amendment four to the extension agreement for management, operations and maintenance services, dated May 20, 2024. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD and Veolia. 2024d. Amendment five to the extension agreement for management, operations and maintenance services, dated June 10, 2024. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD and Veolia. 2024e. Amendment six to the extension agreement for management, operations and maintenance services, dated October 28, 2024. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 7 pp.

MMSD and Veolia. 2025. Amendment seven to the extension agreement for management, operations and maintenance services, dated August 21, 2025. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 4 pp.

MMSD and Veolia. 2026. Amendment eight to the extension agreement for management, operations and maintenance services, dated February 23, 2026. Milwaukee Metropolitan Sewerage District, Milwaukee, WI. 2 pp.

Ohring, M. 1995. Engineering Materials Science. Academic Press, San Diego, CA. 827 pp.

Smith, D. J. 2011. Reliability, maintainability and risk: Practical methods for engineers including reliability centred maintenance and safety-related systems. Eighth edition. Butterworth-Heinemann, Oxford, UK. 436 pp.

U.S. EPA. 1973. Supplement to federal guidelines: design, operation, and maintenance of wastewater treatment facilities. Design criteria for mechanical, electrical, and fluid system and component reliability. EPA-430-99-7. U. S. Environmental Protection Agency. 58 pp.

Veolia. No date-a. Standard maintenance procedure: RAS pumps. Jones Island unit process #5/#6 – activated sludge pumping. Veolia Water Milwaukee, LLC. 4 pp.

Veolia. No date-b. Standard maintenance procedure: primary clarifier tanks and collector mechanisms. Jones Island unit process #4 – primary clarifiers. Veolia Water Milwaukee, LLC. 7 pp.

Veolia. 2001. SOP: wet weather strategy – Jones Island. JI unit process 1&2 – preliminary building. Issued March 3, 2001. Final revision dated August 8, 2012. Veolia Water Milwaukee, LLC. 12 pp.

Veolia. 2011a. Standard maintenance procedure: east secondary clarifiers. Jones Island unit process #6 – secondary clarifiers. Issued August 22, 2011. Veolia Water Milwaukee, LLC. 4 pp.

Veolia. 2011b. Standard maintenance procedure: new east and west secondary clarifiers. Jones Island unit process #6 – secondary clarifiers. Issued August 22, 2011. Veolia Water Milwaukee, LLC. 7 pp.

WDNR. 2015. State of Wisconsin Department of Natural Resources permit to discharge under the Wisconsin Pollutant Discharge Elimination System for Milwaukee Metro Sewerage District Combined. WPDES Permit No. WI-0036820-03-1. Effective date of modification January 1, 2015. Expiration date December 31, 2017. Wisconsin Department of Natural Resources. 83 pp.

WDNR. 2019. State of Wisconsin Department of Natural Resources permit to discharge under the Wisconsin Pollutant Discharge Elimination System for Milwaukee Metropolitan Sewerage District Combined. WPDES Permit No. WI-0036820-04-0. Effective date April 1, 2019. Expiration date March 31, 2024. Wisconsin Department of Natural Resources. 81 pp.